COLLINS

maintenance manual

(with installation data)

Collins Radio Company

51RV-1
VOR/ILS Receiver

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51RV-1
VOR/ILS Receiver

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51R V-1 VOR/ILS Receiver

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1	Improve Off-Course Signal Handling Capability of Localizer Circuit When Used With Localizer Comparator Unit	1/2	Mar 1/66
2	Improve Mounting of Handle to Front Panel (ATR)	1/2	Mar 1/66
3	Improve Operation of Receivers Connected to Same Antenna	1/2	Mar 1/66
4	Delay Operation of ILS-Engergize Relay	1/2	Mar 1/66
5	Installation of VOR Test Switch	1/2	Mar 1/66
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7	Increase Voltage Rating of Capacitor C125 in B+ Distribution Circuit of 51X-4 Receiver	1/2	Mar 1/66
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13	Eliminate Radiated Motor Noise	1/4	Jan 27/69
14	Added Circuit for Flag Operation of +16 Volt Supply Increase	1/4	Jan 27/69
15	Improved Voltage Regulator Performance and Increased Receiver Transient Protection	1/4	Jan 27/69
16	Installing Electrical Grounding Clips on Crystal Covers	1/4	Jan 27/69
17	Replacement of Outdated Transistors Used in IF. Amplifiers	1/4	Jan 27/69

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51RV-1 VOR/ILS Receiver
Figure 1

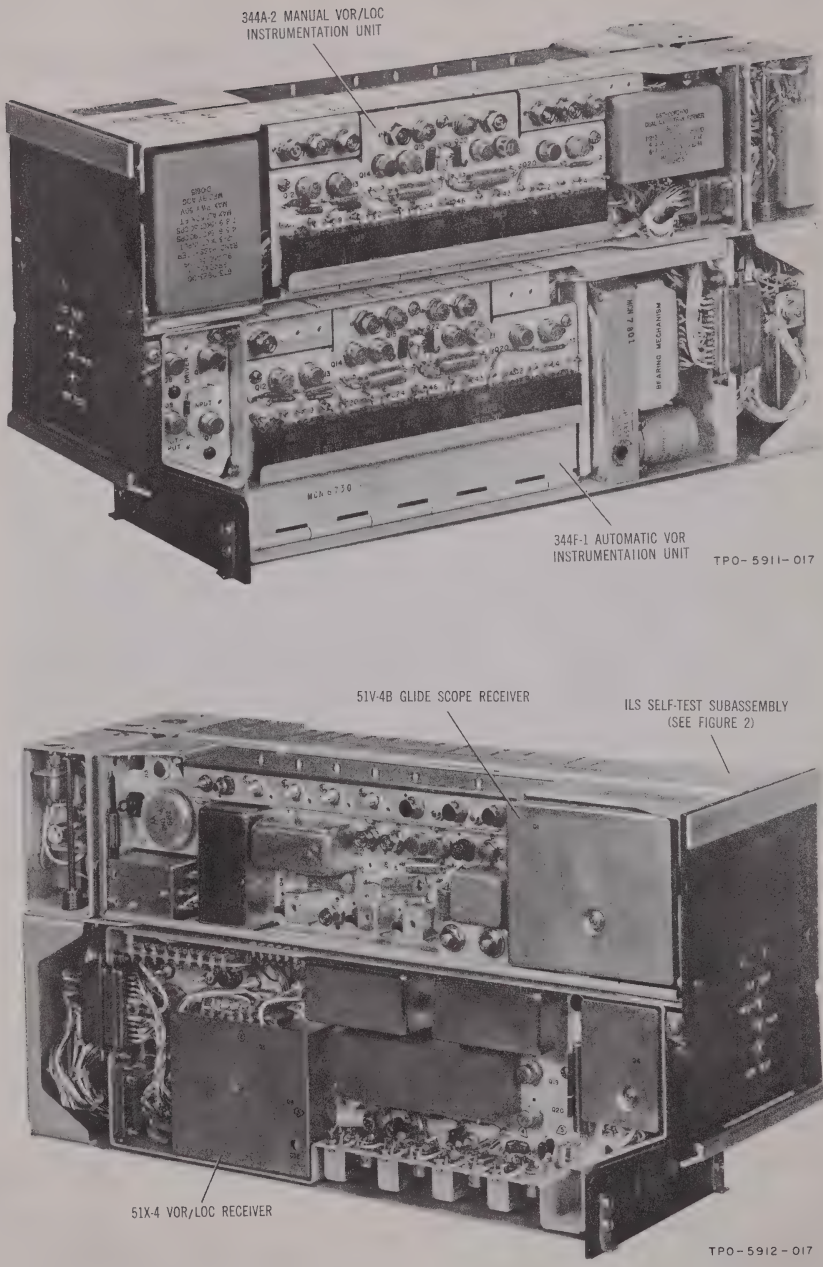
51RV-1 VOR/ILS Receiver - Description and Operation

1. GENERAL.

A. Purpose of Manual.

This manual provides information required to install and maintain the 51RV-1 VOR/ILS Receiver. Included is a description of the equipment, a general theory of operation, preinstallation testing procedures, mounting and cabling information, testing information, and maintenance procedures that can be performed by line maintenance personnel. The 51RV-1 is shown in figure 1. Figure 2 lists the equipment covered in this manual.

51RV-1 MODEL	COLLINS PART NUMBER	DIMENSIONS (in.)			WEIGHT (lb)
		WIDTH	LENGTH	HEIGHT	
Includes VOR self-test and power flag amplifiers	522-2450-00	4-7/8	12-9/16	7-5/8	18.5
Includes VOR self-test, power flag and RMI servo amplifiers	522-2450-011	4-7/8	12-9/16	7-5/8	18.6
Includes VOR self-test and RMI servo amplifier	522-2450-012	4-7/8	12-9/16	7-5/8	17.9
Includes VOR self-test	522-2450-013	4-7/8	12-9/16	7-5/8	17.9
Includes VOR and ILS self-test and power flag amplifiers	522-2450-014	4-7/8	12-9/16	7-5/8	17.9
Includes VOR and ILS self-test, power flags, and RMI servo amplifier	522-2450-015	4-7/8	12-9/16	7-5/8	19
Includes VOR and ILS self-test and RMI servo amplifier	522-2450-016	4-7/8	12-9/16	7-5/8	18.4
Includes VOR and ILS self-test	522-2450-018	4-7/8	12-9/16	7-5/8	18.3
Includes VOR and ILS self-test, power flags, RMI servo amplifier and FLOUT (flag location out under test) circuit	522-2450-020	4-7/8	12-9/16	7-5/8	19



51RV-1 VOR/ILS Receiver, Left and Right Views
Figure 3

B. Purpose of Equipment.

The purpose of the 51RV-1 VOR/ILS Receiver is to receive VOR, localizer, and glideslope signals and convert the information received to operate deviation, flag, and to-from indicators. The 51RV-1, shown in figure 1, is available in several models as listed in figure 2.

Four models contain power flag amplifiers to operate a master glideslope and VOR/LOC alarm system. These outputs are in addition to the standard indicator outputs.

Four models of the 51RV-1 contain a servo amplifier module. The amplifier in this module receives an input from a magnetic compass system and supplies an output to drive an RMI compass card motor.

Four models of the 51RV-1 contain an ILS self-test module. This module provides signals to test the ILS audio and instrumentation circuits.

All models of the 51RV-1 contain VOR self-test circuits. This circuit provides signals to test the VOR instrumentation sections of the 51RV-1.

One model of the 51RV-1 contains a FLOUT (flag location out under test) circuit that controls the location of the VOR/LOC flag during VOR self-test.

UNIT	FUNCTION	COLLINS PART NUMBER	DIMENSIONS (inches)			WEIGHT (lb)
			WIDTH	LENGTH	HEIGHT	
51V-4B	Glideslope receiver	522-3195-00	2-9/64	12-5/8	3-9/64	3.3
51X-4	VOR/LOC receiver	522-3196-00	2	12-5/16	4-3/16	3.6
344A-2	Manual VOR/LOC unit	522-2494-00	2-9/64	13-1/4	3-7/64	4.2
344F-1	Automatic VOR unit	522-3197-00 (with RMI servo amplifier)	2-1/16	12-3/4	4-1/4	4.0

51RV-1 Units (Sheet 1 of 2)
Figure 4

UNIT	FUNCTION	COLLINS PART NUMBER	DIMENSIONS (inches)			WEIGHT (lb)
			WIDTH	LENGTH	HEIGHT	
		522-3197-011 (without RMI servo amplifier)				
ILS self-test module	Provides test for ILS sections	756-3816-005	11/32	12-15/32	3-3/32	0.4
T-frame	Support for above units (without ILS self-test)	553-6534-015 (with power flags)	4-7/8	14-5/8	7-5/8	3.4
		553-6534-005 (without power flags)				
	Support for above units (with ILS self-test)	756-3838-015 (with power flags)				
		756-3838-005 (without power flags)				

51RV-1 Units (Sheet 2 of 2)
Figure 4

Figure 5 is a list of the associated equipment which may be used with the 51RV-1.

EQUIPMENT	COLLINS PART NUMBER	DESCRIPTION	FUNCTION
37P-4 Antenna	522-0688-013	For use with single glide-slope receiver, 0.7 lb.	Receives glideslope signals (uhf).
37P-5 Antenna	522-0700-003	For use with two glide-slope receivers, 0.7 lb	Receives glideslope signals (uhf).

Associated Equipment (Sheet 1 of 2)
Figure 5

EQUIPMENT	COLLINS PART NUMBER	DESCRIPTION	FUNCTION
Type N coaxial plug	557-9040-00	UG-21B/U, 0.1 lb.	Antenna connector.
BNC-to-N adapter	357-9056-00	UG-201/U, 0.1 lb.	For use with 37P-4 Antenna.
37J-3 Antenna	505-6800-00	VOR/LOC antenna, 5.75 lb.	Receives VOR/LOC signals (vhf).
313N-1 Control 313N-2 Control 313N-3 Control	*522-2446-024 *522-2447-005 *522-2448-005	Remote control.	Provides remote frequency, volume, and self-test control.
329B-( ) series		Used with flight director systems	Provides aircraft position with respect to glideslope beam and computed lateral guidance steering information.
331A-( ) series		Used with flight director systems	Provides pictorial display of aircraft position with respect to localizer course or omnirange radio.
Radio magnetic indicator (RMI)	482-0061-00	332C-4 RMI	Provides magnetic heading and station bearing information.
390Y-1 Mount	522-3060-00	Shockmount, 1.7 lb.	Provides shockmounting for the 51RV-1.

*For detailed information and optional controls, refer to 313N-1/2/3 instruction books.

Associated Equipment (Sheet 2 of 2)
Figure 5

C. Related Publications.

Figure 6 lists other publications concerning the 51RV-1 and associated equipment. Overhaul manuals contain complete disassembly, cleaning, inspection, assembly, testing, and troubleshooting instructions, and detailed theory of operation.

PUBLICATION	COLLINS PART NUMBER
51RV-1 VOR/ILS Receiver Overhaul Manual (with Illustrated Parts Catalog)	523-0756524
313N-1 Control Instruction Book	523-0722000
313N-2 Control Instruction Book	523-0754001
313N-3 Control Instruction Book	523-0752001
329B Series	Various
331A Series	Various
37P-2/3/4/5 Glideslope Antenna Instruction Book	523-0755809
37J-3 VHF Navigation Antenna Unit Instructions	523-0755092
390Y-1/2 Shockmount Overhaul Manual	523-0756911
332C-4 Radio Magnetic Indicator Instruction Book	523-0760309

Associated Equipment Publications
Figure 6

2. EQUIPMENT SPECIFICATIONS.

Figure 7 is a table of the 51RV-1 characteristics and specifications. The 51RV-1 meets TSO-C36a, C40a and C34a requirements.

CHARACTERISTIC	SPECIFICATION
TSO compliance	C34a, C36a, C40a (Category A)
Power requirements	
VOR operation	27.5 volts dc, 1.45 A 26 volts, 400 Hz, 0.23 A

Equipment Specifications (Sheet 1 of 4)
Figure 7

CHARACTERISTIC	SPECIFICATION
ILS operation	27.5 volts dc, 1.82 A 26 volts, 400 Hz, 0.23 A
Channeling	No additional power required
Environmental requirements	
Temperature	
Continuous operation	-54 to +55 °C (-65 to +131 °F)
Intermittent operation (30 minutes maximum)	Up to +71 °C (+160 °F)
Storage	-65 to +85 °C (-85 to +185 °F)
Humidity	Up to 95 percent at +50 °C (+122 °F) for 48 hours with moisture condensation on equipment once each hour.
Altitude	Up to 45,000 feet.
Shock	
Receiver in shockmount	15 g operating; 30 g impact (10 ms duration).
Receiver in rigid mount	6 g operating; 15 g impact (10 ms duration).
Vibration	
Receiver in shockmount	0.08 inch double amplitude, 5 to 10 Hz, 0.42 g, 10 to 15 Hz; 0.036 inch double amplitude, 15 to 65 Hz; constant 8 g, 65 to 500 Hz.
Receiver in rigid mount	0.02 inch double amplitude, 5 to 55 Hz with 3 g maximum, constant 1.5 g, 55 to 500 Hz.
VOR/LOC performance	
Frequency range	108.00 to 117.95 MHz in 50-kHz increments.

Equipment Specifications (Sheet 2 of 4)
Figure 7

CHARACTERISTIC	SPECIFICATION
Sensitivity	
Aural channel	3-uv input for 6-db (s + n)/n ratio.
VOR channel	3-uv input for satisfactory navigation performance.
Selectivity	40 kHz at -6-db points and 68 kHz at -60-db points with 3-db or less ripple.
Spurious response	At least 70 db down.
Gain	100-mw output into a 600-ohm load with a 5-mv input signal modulated 30 percent with 1000 Hz.
Agc characteristics	Not more than 3-db variation from 5 to 50,000 uv.
Frequency stability	0.004 percent from +10 to +55 °C (+50 to +131 °F) 0.005 percent from -55 to +71 °C (-67 to +160 °F).
Navigation outputs	Five deviation indicator loads, four flag indicator loads, two TO-FROM loads and two RMI pointer loads.
Power flag outputs	18 vdc at 250 ma (minimum) at minimum line voltage.
Glideslope performance	
Frequency range	329.3 to 335.0 MHz in 300-kHz increments.
Selectivity	140 kHz minimum at -6-db points, 450 kHz maximum at -60-db points.
Sensitivity	20-uv input with a 2-db audio ratio required to obtain a 47-ua deflection (course sensitivity set at 78-ua deflection for standard glideslope deviation input).
Spurious response	At least 60 db down in the 0.09- to 1500-MHz range.

Equipment Specifications (Sheet 3 of 4)
Figure 7

CHARACTERISTIC	SPECIFICATION
Agc characteristic	Adjustable to vary audio rise from +5 percent to -15 percent when input is increased from 700 to 14,000 uv.
Frequency stability	0.01 percent from -55 to +71 °C (-67 to +160 °F).
Navigation outputs	Five deviation indicator loads and four flag indicator loads.
Power flag output	18 vdc at 250 ma (minimum) at minimum line voltage.
ILS test performance	27.5 volts dc +10 -20%, 0.14 A maximum.
Frequency stability	-20 to +55 °C (-4 to +131 °F) ±1% max, ±0.5% typical.
	-55 to +71 °C (-67 to +160 °F) ±2% max, ±1% typical.
Deviation stability	-20 to +55 °C (-4 to +131 °F) ±15% max, 7% typical.
	-55 to +71 °C (-67 to +160 °F) ±20% max, 12% typical.
Range of adjustment:	
Master oscillator frequency	445 to 455 Hz.
Localizer deviation current	50 to 150 ua, loaded.
Localizer flag current	0 to 400 ua, loaded.
Glideslope deviation current	50 to 150 ua, loaded.
Glideslope flag current	0 to 400 ua, loaded.

Equipment Specifications (Sheet 4 of 4)
Figure 7

3. GROUND FACILITIES.

A. Glideslope System.

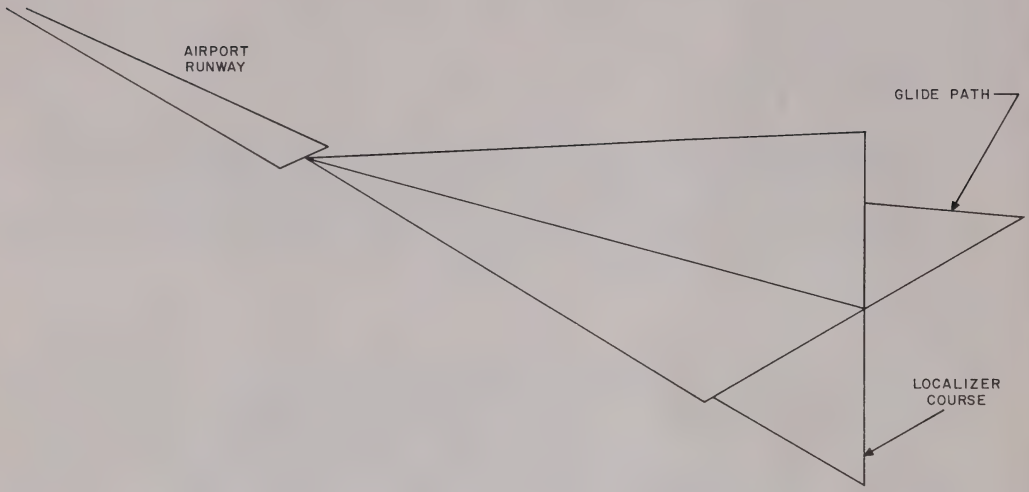
The glideslope rf carrier is radiated in the 329.3- to 335.0-MHz frequency range. A complex antenna array effectively radiates two intersecting lobes, one above the other. The upper lobe is predominantly modulated with 90 Hz, and the lower lobe is predominantly modulated with 150 Hz. On a line at an angle of 2.5 degrees from the runway, the two audio signals (90 and 150 Hz) are equal in magnitude. This line defines the glide path and is shown in figure 8.

B. Localizer System.

The localizer rf carrier is radiated in the 108.10- to 111.90-MHz frequency range. A complex antenna array effectively radiates two intersecting lobes, each directed along one side of the runway. The lobe to the left of the approach end of the runway is predominantly modulated with 90 Hz, and the lobe to the right is predominantly modulated with 150 Hz. The two audio signals (90 and 150 Hz) are equal in magnitude along a line bisecting the center of the runway. This line defines the localizer course and is shown in figure 8.

C. VHF Omnirange (VOR) System.

The principle of VOR navigation is phase comparison of two 30-Hz audio signals. One audio signal is modulated on the rf carrier and radiated with a constant phase. This is the reference 30-Hz signal. The other audio signal, called the variable 30-Hz signal, is modulated on the rf carrier and radiated so its phase lags the reference 30 Hz by the bearing (degrees) from the station. The variable 30-Hz signal amplitude modulates the rf carrier, and the reference 30-Hz signal frequency modulates a 9960-Hz subcarrier which is amplitude modulated on the rf carrier. The purpose of this subcarrier modulation is to provide a means of discriminating between the two 30-Hz signals when received. The reference (R) and Variable (V) 30 Hz are shown in figure 9 as they modulate the rf carrier (as they are received and detected), with the variable 30-Hz signal phase varying with the bearing.



Glideslope and Localizer Radiation Patterns
Figure 8

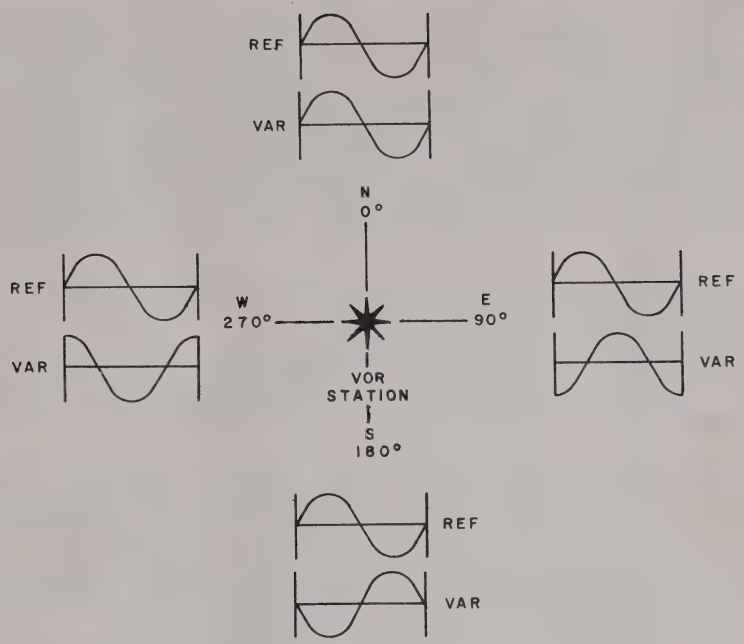
4. EQUIPMENT DESCRIPTION.

A. 51V-4B Glideslope Receiver.

The 51V-4B receives the glideslope rf carrier, detects, and compares the 90- and 150-Hz audio signals, and provides an output for the glideslope deviation needle and flag alarm of the course indicator.

B. 51X-4 VOR/LOC Receiver.

The 51X-4 receives the VOR/LOC rf carrier and detects the audio frequencies. Aural signals are fed to the aircraft intercom system, and VOR/LOC signals are fed to the instrumentation units.



VOR Radiation Principle
Figure 9

C. 344A-2 Manual VOR/LOC Instrumentation Unit.

The 344A-2 compares the localizer 90- and 150-Hz audio signals detected in the 51X-4 and provides a dc output for the localizer deviation needle and flag alarm of the course indicator. The reference 30-Hz signal is demodulated from the 9960-Hz subcarrier in the 344A-2 FM circuitry. A comparator in the 344A-2 detects the phase difference of the reference and variable 30-Hz signals and provides a dc output for the VOR deviation needle, flag alarm, and to-from indicator of the course indicator.

D. 344F-1 Automatic VOR Instrumentation Unit.

The 344F-1 compares the variable 30-Hz and the demodulated reference 30-Hz (from the 344A-2) signals and provides a synchro output to drive a needle on the radio magnetic indicator (RMI).

E. VOR Self-Test.

The VOR test provides a 30-Hz signal that can be used to give a quick check of the VOR system. To perform this test a local VOR frequency should be selected, the OBS should be set to 0 degree or 180 degrees, and the VOR test switch should be actuated. The deviation bar should center and the RMI pointer should indicate approximately 180 degrees. (With the -020 status only, the VOR/LOC flag on the course indicator becomes visible at the same time.)

F. ILS Self-Test.

An ILS self-test module is part of the 51RV-1 VOR/ILS Receivers having Collins part numbers 522-2450-014, -015, -016, -018, and -020. This module provides a combined 90- and 150-Hz signal that can be used to check the ILS receiver system accuracy from the first audio stages through the indicators. When the UP/LEFT switch is actuated, the deviation bar moves to the left, the glideslope bar moves up, the VOR/LOC flag disappears, and the glideslope flag disappears. When the DOWN/RIGHT switch is actuated, the deviation bar moves to the right, the glideslope bar moves down, the VOR/LOC flag disappears, and the glideslope flag disappears.

5. THEORY OF OPERATION

A. 51V-4B Block Diagram Theory.

The 51V-4B (block diagram shown in figure 12) is a completely solid-state, 20-channel, dual-conversion receiver. The 2-out-of-5 binary switching selects first oscillator Q1 crystals. A regulated power supply provides constant voltage for all stages.

The rf input from the glideslope antenna is coupled through a bandpass filter to first mixer CR14. The first oscillator Q1 output frequency is coupled through tripler Q14 and injection amplifier Q15 to the first mixer. The difference frequency is selected in the mixer output and coupled through 30-MHz amplifier Q2 and filter FL1 to the second oscillator-mixer Q3. The 30-MHz signal is mixed with the oscillator frequency of 26.9 Mhz. The difference frequency is selected and coupled through 3.1-MHz filter FL2 to first 3.1-Mhz if. amplifier Q4.

The if. signal is transformer coupled through three stages of amplification (Q4-Q6) to the detector. The detector output is applied to transistor Q7 which acts as an emitter-follower for audio signals and as a dc amplifier for the agc voltage. The agc output is coupled to second agc amplifier, Q8, and the audio output is coupled to first audio amplifier Q9. Agc voltage output of the second agc amplifier is applied to 30-MHz if. amplifier Q2 and to the first two 3.1 MHz if. amplifiers (Q4 and Q5). A portion of the agc voltage is also applied to first audio amplifier Q9 through a course-softening potentiometer which provides reduced deflection sensistivity when the aircraft nears the runway. The output from first audio amplifier Q9 is transformer coupled to a push-pull audio amplifier (Q10 and Q11). The audio amplifier output, consisting of the 90- and 150-Hz glideslope signals, is separated and applied to a comparator. The comparator output is fed to the glideslope deviation needle and flag alarm of the course indicator.

B. 51X-4 Block Diagram Theory.

The 51X-4 (block diagram shown in figure 12) is a completely solid-state, 200-channel, triple-conversion receiver. The 2-out-of-5 binary switching selects the crystals for the three oscillators and tunes the rf amplifier input and output circuits for each megahertz of the frequency range. A regulated power supply provides constant voltage for all stages.

The rf input from the VOR/LOC antenna is coupled through three tuned circuits to rf amplifier Q1. The rf amplifier output is coupled through a tuned interstage circuit

to first mixer Q2, where it is mixed with the amplified output of vhf oscillator Q4. The difference frequency is selected and coupled through 22-MHz filter FL1 to second mixer Q10, where it is mixed with the output of 10-channel hf oscillator Q5. A 4.6-MHz filter (FL2) in the output of the second mixer couples the difference frequency to third mixer Q11. An output from 2-channel hf oscillator Q6 is also coupled to the third mixer. The difference frequency in the third mixer is coupled through a 500-kHz filter (FL3) to first 500-kHz if. amplifier Q12. The if. signal is transformer coupled through four stages of amplification (Q12-Q15) to detector CR62. The detector output is applied to agc amplifier Q18, noise limiter CR64, and the VOR/LOC output terminals.

The output of the agc amplifier is applied to the rf amplifier (Q1) and the first two 500-kHz if. amplifier stages (Q12 and Q13). The noise limiter output is coupled through four amplifiers (Q16, Q17, Q19, and Q20) to the receiver aural output terminals. This aural output, when applied to the aircraft headphones, enables the pilot to listen to information transmitted by voice on the VOR/LOC carrier. The VOR/LOC audio frequencies are fed to the VOR/LOC output terminals. These signals, 90, 150, 30, and 9960 Hz, are attenuated by a filter in the aural amplifier stages.

C. Instrumentation Units Block Diagram Theory.

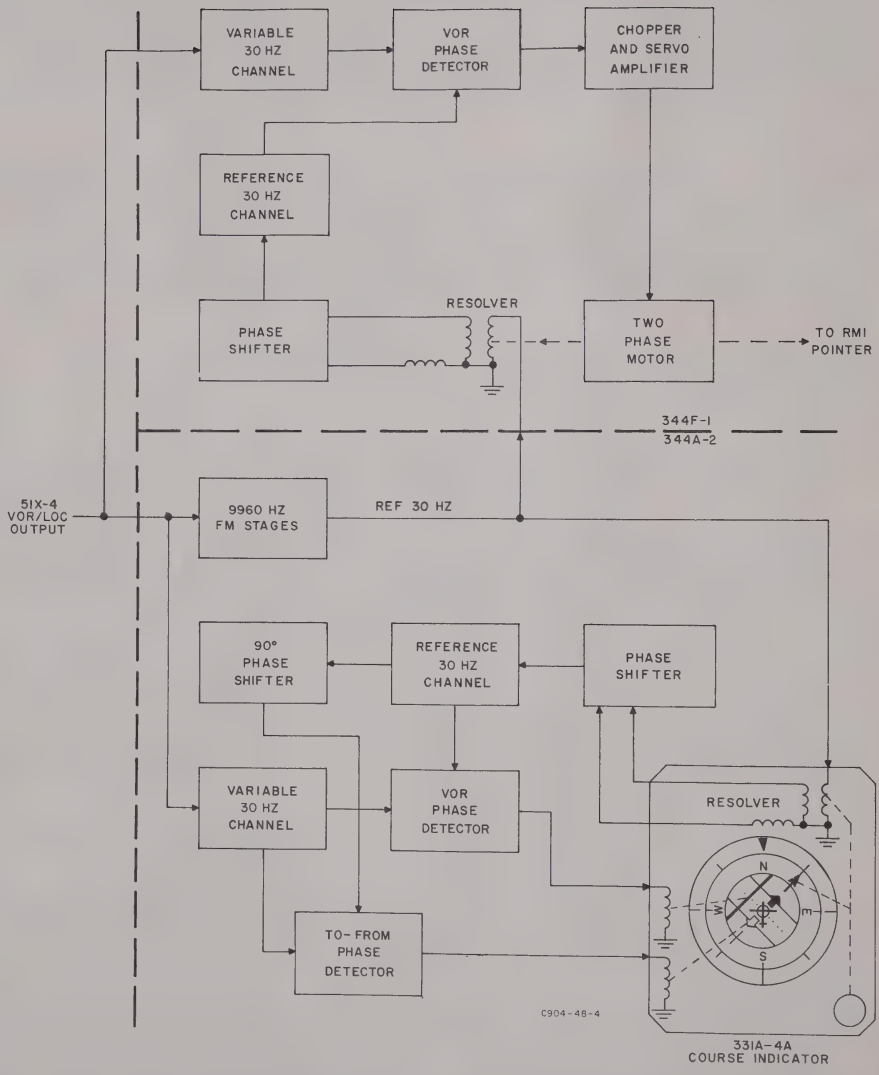
(1) General.

The purpose of each instrumentation unit is to determine the amount of phase difference between the radiated reference and variable 30-Hz signals after they are detected. The two signals are coupled from the 51X-4 VOR/LOC output through two separate channels in each instrumentation unit to a phase detector where the difference in phase is detected. The reference 30 Hz is coupled through a phase shifter where the phase of the 30 Hz can be varied by turning a resolver rotor. Each of the 51RV-1 instrumentation units employs a different means to turn the resolver rotor. Refer to figure 10.

The resolver in the 344A-2 reference 30-Hz channel is located in the course indicator, and the rotor is ganged to the COURSE knob. When the pilot selects a course, he shifts the phase of the reference 30 Hz. The 344A-2 instrumentation circuits detect this phase shift and provide outputs for the course indicator deviation needle, flag alarm, and to-from indicator. The deviation needle is centered when the aircraft is on the course selected.

The resolver rotor in the 344F-1 is turned by a 2-phase motor, within the unit, which is driven by the phase detector output. This 2-phase motor also turns a synchro differential which provides an output to drive the RMI needle. When the RMI needle indicates the bearing to the station, the 344F-1 phase detector output is zero, and the 2-phase motor stops. An automatic continuous reading of the bearing to the station is thus provided.

The accuracy of both instrumentation units is checked when the VOR test control is activated. A 30-Hz test signal is then fed through the variable signal channels in each unit. The 344A-2 output provides a FROM indication and centers the deviation needle when the course knob is set to select a 0-degree course. The 344F-1 output drives the RMI needle to 180 degrees.



VOR Operation, Simplified Diagram
Figure 10

(2) 344A-2 Block Diagram Theory. (Refer to figure 12.)

When the 51RV-1 is tuned to a VOR frequency, localizer switch CR11 is biased to cut off amplifier Q9. When the 51RV-1 is tuned to a localizer frequency in the 108.10- to 111.90-MHz (odd tenths megahertz) frequency range, localizer switch CR11 is biased to allow amplifier Q9 to raise the level of the 90- to 150-Hz signals from the 51X-4 VOR/LOC output and couple these signals through output amplifiers Q10 and Q11 to the localizer output circuit. The output circuit detects the amplitude difference of the 90- and 150-Hz signals and applies an output to the deviation and flag alarm of the course indicator.

The variable 30-Hz VOR signal in the 51X-4 VOR/LOC output is coupled to the variable channel low-pass filter when the 51RV-1 is tuned to a VOR station. The low-pass filter attenuates the 9960-Hz subcarrier and couples the variable 30 Hz to the variable 30-Hz amplifier, Q19 through Q25. The propeller modulation filter between amplifiers Q20 and Q21 attenuates harmonics of the 30-Hz signal. The amplifier output is coupled to the VOR and to-from phase detectors. The 9960 Hz, which is the subcarrier for the reference 30 Hz, is coupled from the 51X-4 VOR/LOC output through 9960-Hz amplifiers Q1 and Q2 and limiters CR1, CR2, CR3, and CR4. The amplified square-wave output of the amplifiers and limiters is coupled to the FM detector where the reference 30-Hz envelope is demodulated from the 9960-Hz subcarrier. Reference 30-Hz detectors CR5 and CR6 detect the 30 Hz which is applied to drivers Q4 and Q5. The output of automatic resolver driver Q5 is coupled to resolver B2 in the 344F-1, and the output of manual resolver driver Q4 is coupled to the OBS resolver in the course indicator. The OBS resolver and an RC network in the 344A-2 form a phase shifter. The shifted reference 30 Hz is coupled from the phase shifter to the low-pass filter in the reference channel. The stages following the low-pass filter are identical to the stages following the low-pass filter in the variable channel. The reference 30 Hz is coupled to the VOR phase detector and through a fixed 90-degree phase shifter to the to-from phase detector. The VOR phase detector output is applied to the deviation needle and flag alarm on the course indicator. The phase difference of the reference and variable signals is also detected in the to-from phase detector after the reference signal is shifted 90 degrees. This phase detector applies an output to the course indicator to-from indicator. During VOR test on the -020 status only, the VOR phase detector output is applied through a FLOUT (flag location out under test) circuit before it is applied to the VOR/LOC flag in the course indicator. The FLOUT circuit reduces the flag current and allows the flag to become visible. The phase difference of the reference and variable signals is also detected in the to-from phase detector after the reference signal is shifted 90 degrees. This detector applies an output to the to-from indicator on the external course indicator.

The power supply (Q6-Q8) provides a regulated +16 volts dc for all stages in the 344A-2 and 344F-1. Overvoltage sensor Q27 monitors the +16 volt output of the regulated power supply. If the voltage rises above +16 volts, the audio signal applied to the 344A-2 instrumentation circuits is interrupted. The flag alarm circuit in the 344A-2 interprets this interruption as an unreliable navigation signal and provides a flag output to the external indicators, thus preventing erroneous output indications caused by excessive supply voltages.

(3) 344F-1 Block Diagram Theory. (Refer to Figure 12.)

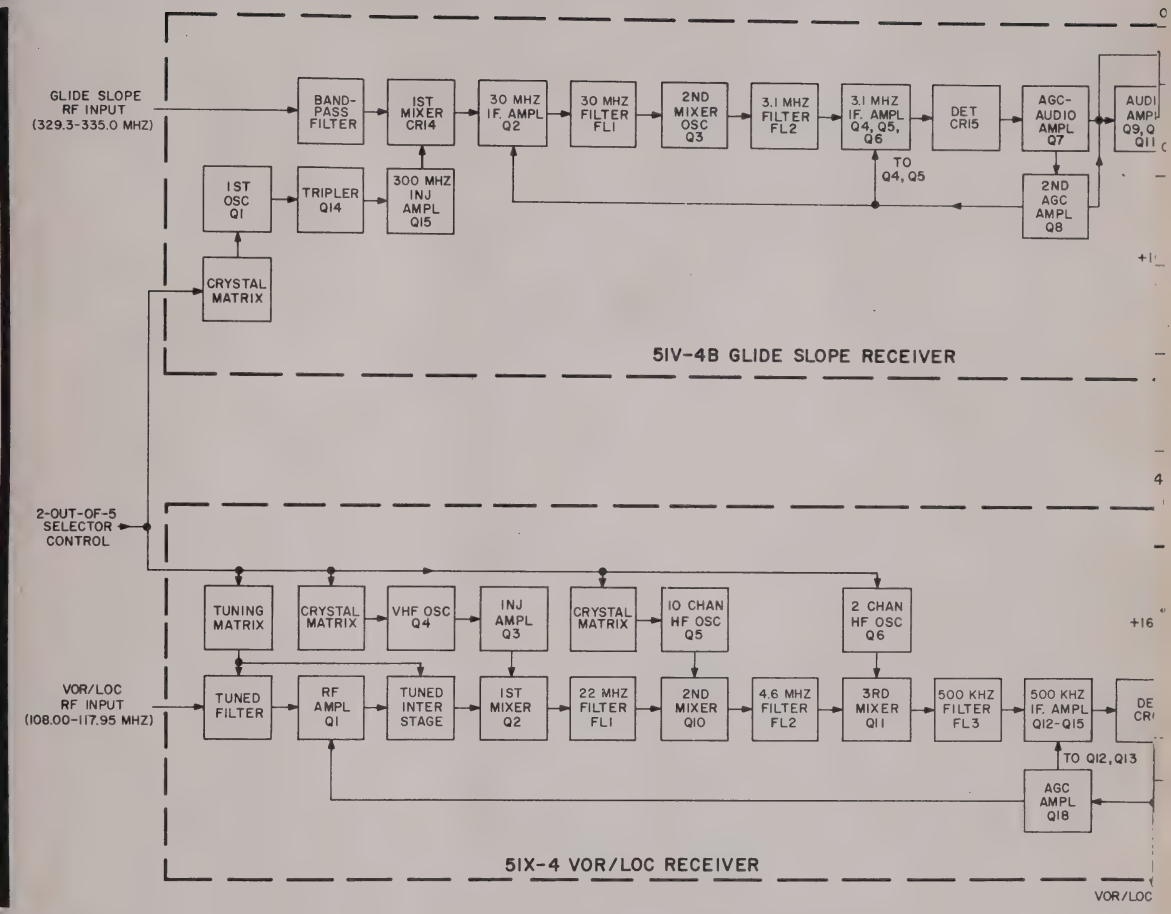
The 30-Hz reference output of the 344A-2 automatic resolver driver Q5 is applied to resolver B2 in the 344F-1 bearing mechanism module. The resolver and an RC network form a phase shifter. The reference 30-Hz is then coupled from the phase shifter (resolver stators) through the reference 30-Hz channel to the VOR phase detector. The variable 30-Hz output of the 51X-4 is applied through the variable 30-Hz channel to the VOR phase detector. The stages in these two channels are identical to the stages in the reference and variable channels in the 344A-2. The variable and reference signals are compared in the VOR phase detector. The phase detector dc output is filtered and converted to an ac voltage which is amplified to drive a 2-phase motor. This motor drives the phase shifter resolver rotor until the reference 30-Hz signal is in quadrature with the variable 30 Hz. The phase detector output will then be zero and the motor will stop. The motor drives a differential synchro which transmits a voltage to the external RMI synchro to drive the needle to a position which indicates the magnetic bearing of the aircraft to the station.

D. 51RV-1 T-Frame

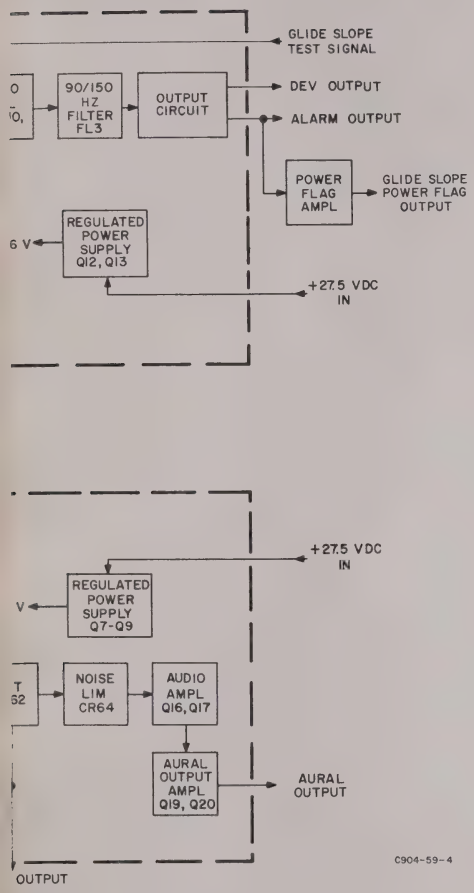
The 51RV-1 frame provides a support for the units described in paragraphs A, B, and C. All units may be adjusted and serviced while they are connected to the frame and operating. The frame includes the necessary cabling and circuits for glideslope/localizer switching, additional flag, deviation, and to-from indicator loads, meter damping capacitors, power flag units, and FLOUT circuit (connected on -020 status only). The power flag units provide an amplified flag alarm output to operate a master warning system. Jumper wires may be connected on the mount connector to add flag and deviation loads from the frame without disturbing any circuit in the 51RV-1. Figure 11 lists the connectors that are located on the 51RV-1 frame and their functions.

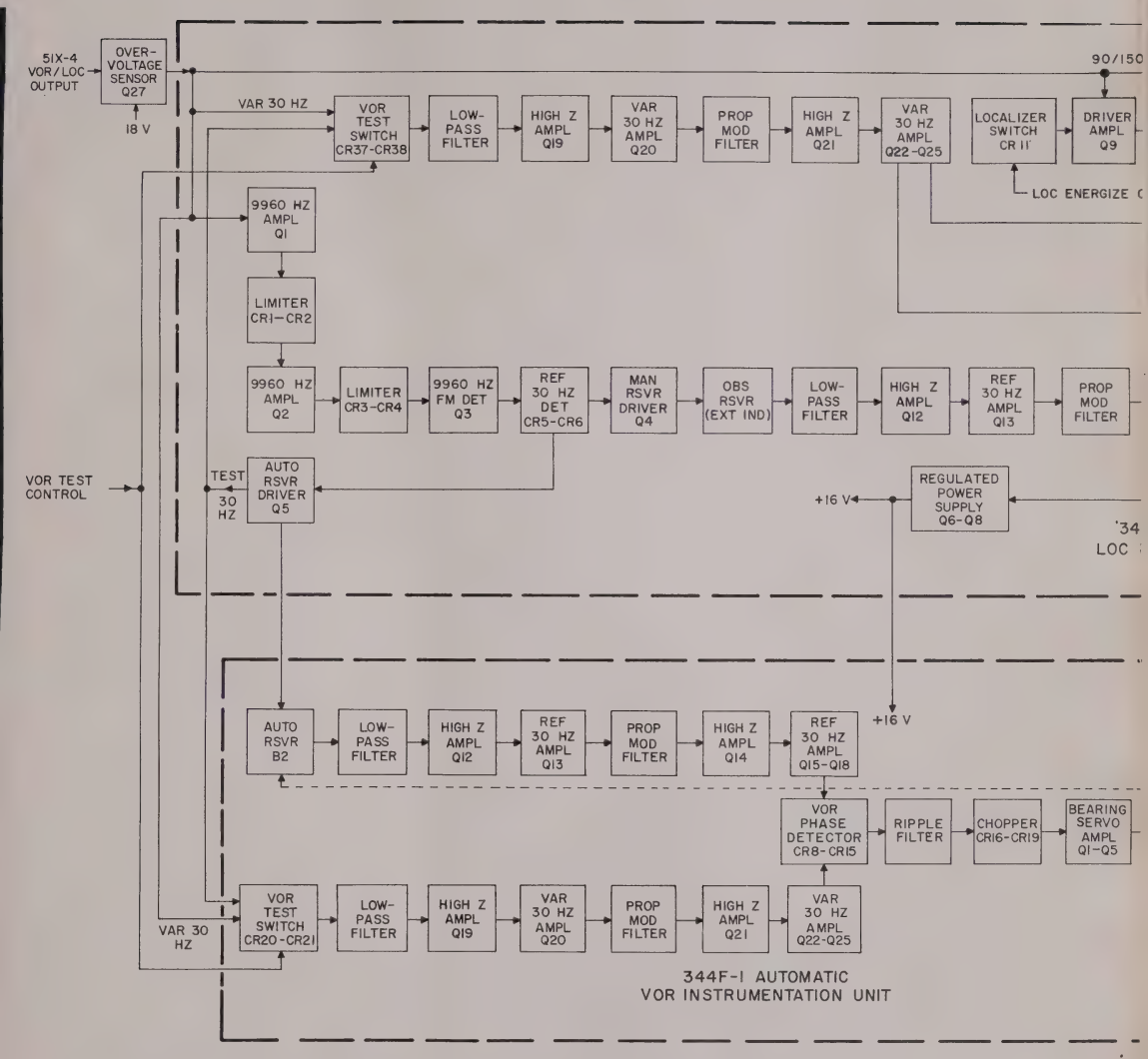
51RV-1 FRAME CONNECTOR	FUNCTION	UNIT MATING CONNECTOR
DPA-24W2-33S-1	Interconnect for the 51V-4B	DPA-24W2-34P-1
DBM-21W1S	Interconnect for the 51X-4	DPM-21W1P
DPA-32-33S-3 (A101)	Interconnect for the 344A-2	DPA-32-34P-3 (A101)
DC-37S(C7)	Interconnect for the 344F-1	DC-37P (C7)
DPX2CA-32W2P57P-34B	51RV-1 main interconnect	DP2CA-32W2P575-33B

51RV-1 Connectors
Figure 11

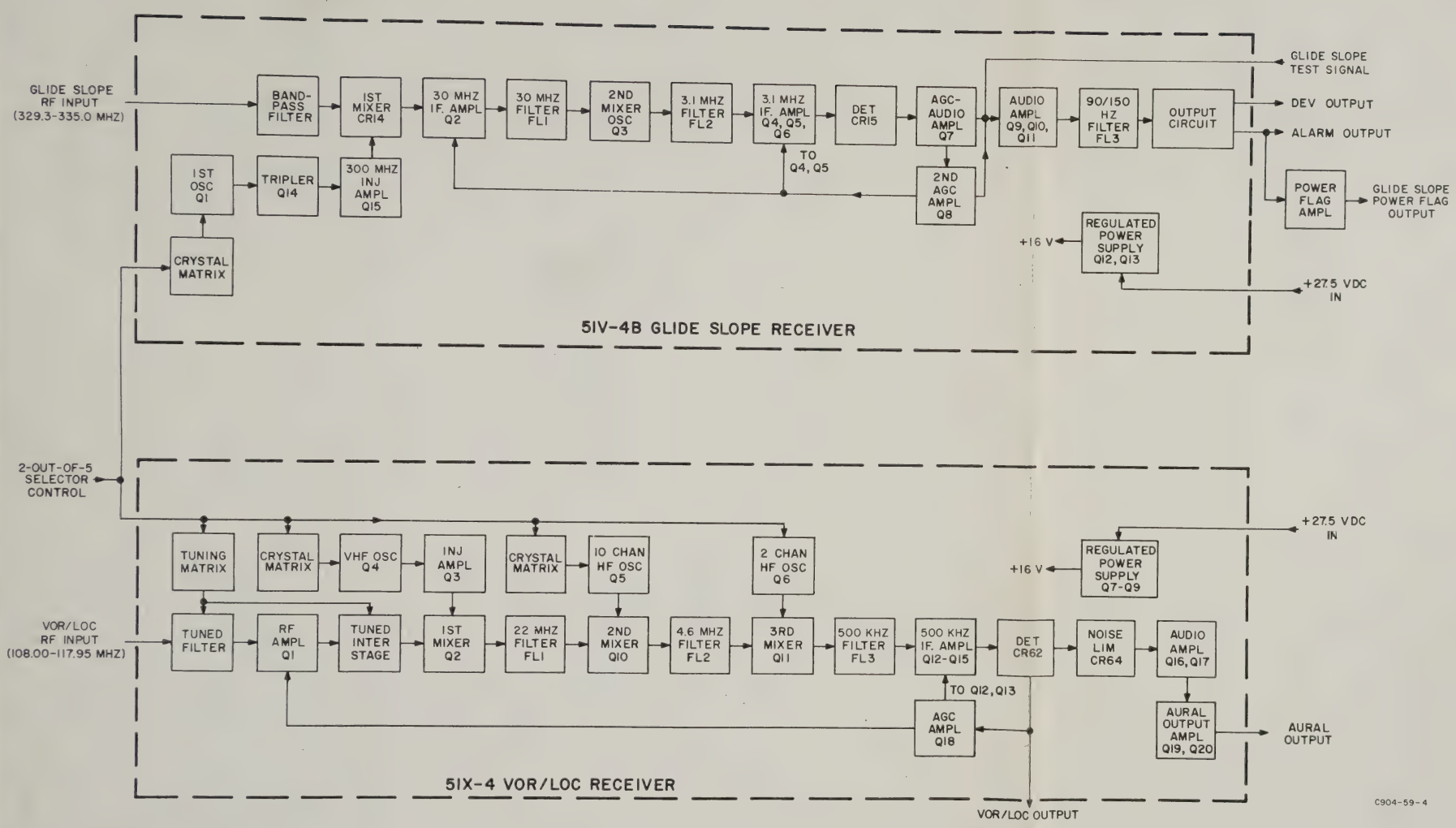


51RV-1 Block Diagram (Sheet 1 of 2)
Figure 12

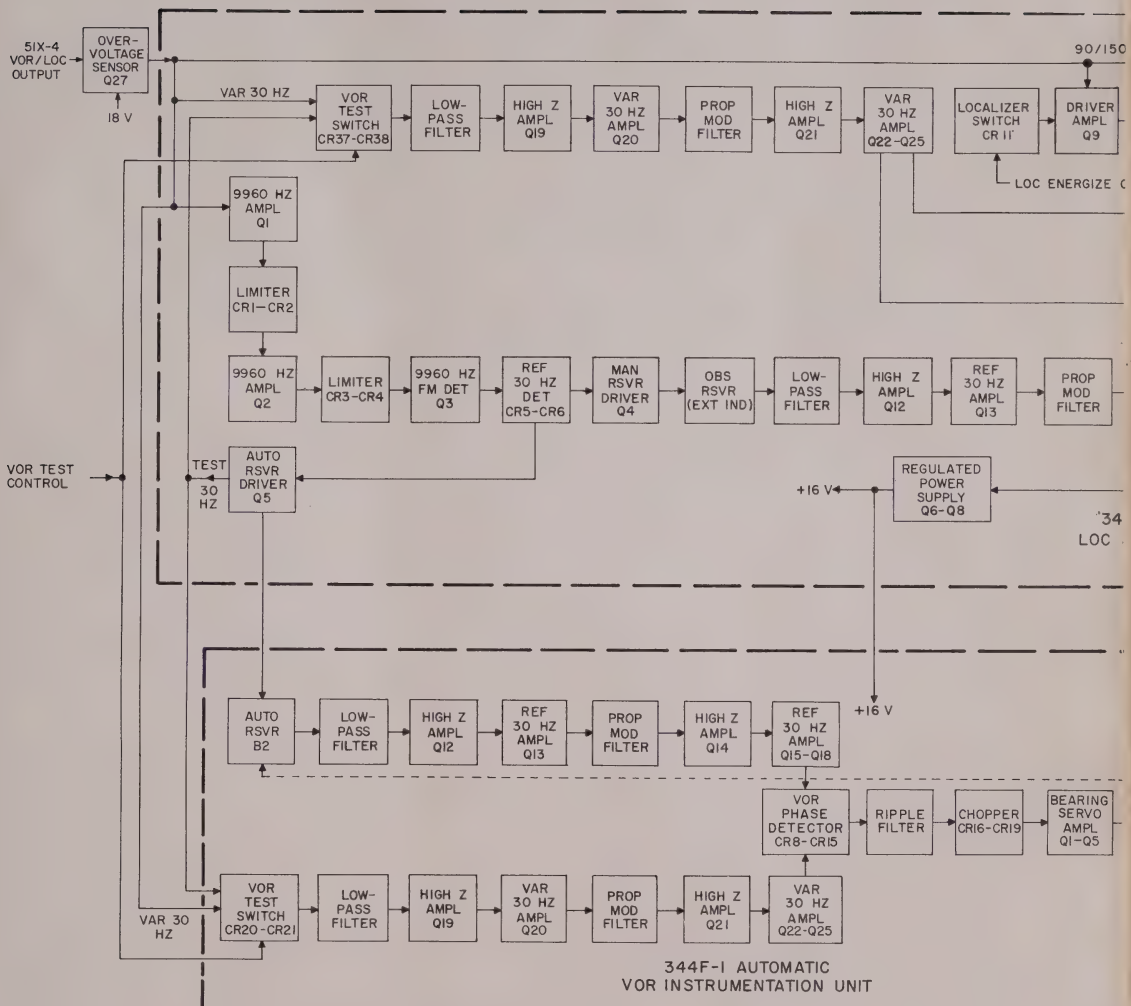

GLIDE SLOPE
TEST SIGNAL
90/150
HZ
FILTER
FL3
OUTPUT
CIRCUIT
DEV OUTPUT
ALARM OUTPUT
POWER
FLAG
AMPL
GLIDE SLOPE
POWER FLAG
OUTPUT
REGULATED
POWER
SUPPLY
Q12, Q13
+27.5 VDC
IN
+27.5 VDC
IN
REGULATED
POWER
SUPPLY
Q7-Q9
NOISE
LIM
CR64
AUDIO
AMPL
Q16, Q17
AURAL
OUTPUT
AMPL
Q19, Q20
AURAL
OUTPUT
C904-59-4



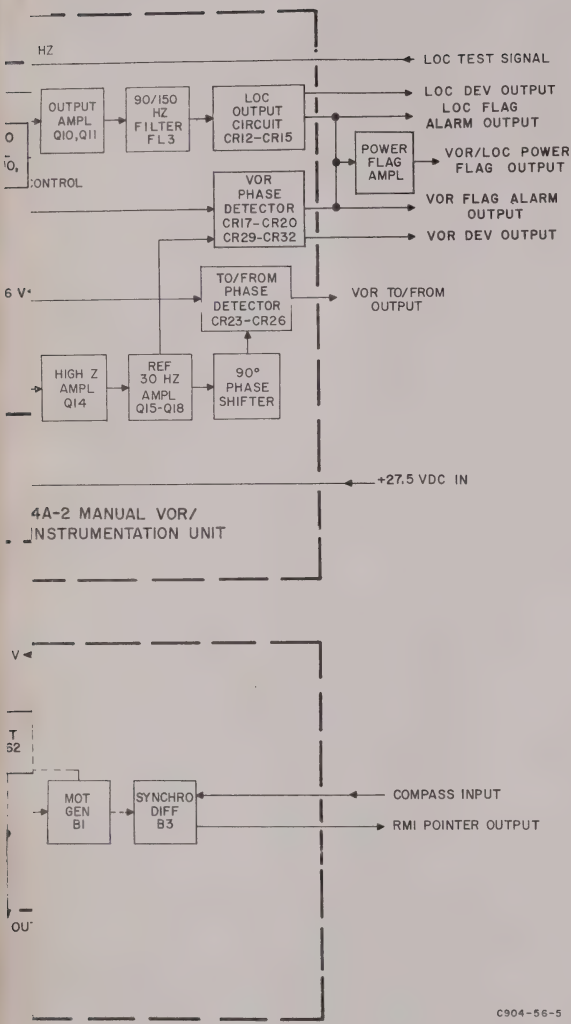
51RV-1 Block Diagram (Sheet 2 of 2)
Figure 12



51RV-1 Block Diagram (Sheet 1 of 2)
Figure 12



51RV-1 Block Diagram (Sheet 2 of 2)
Figure 12

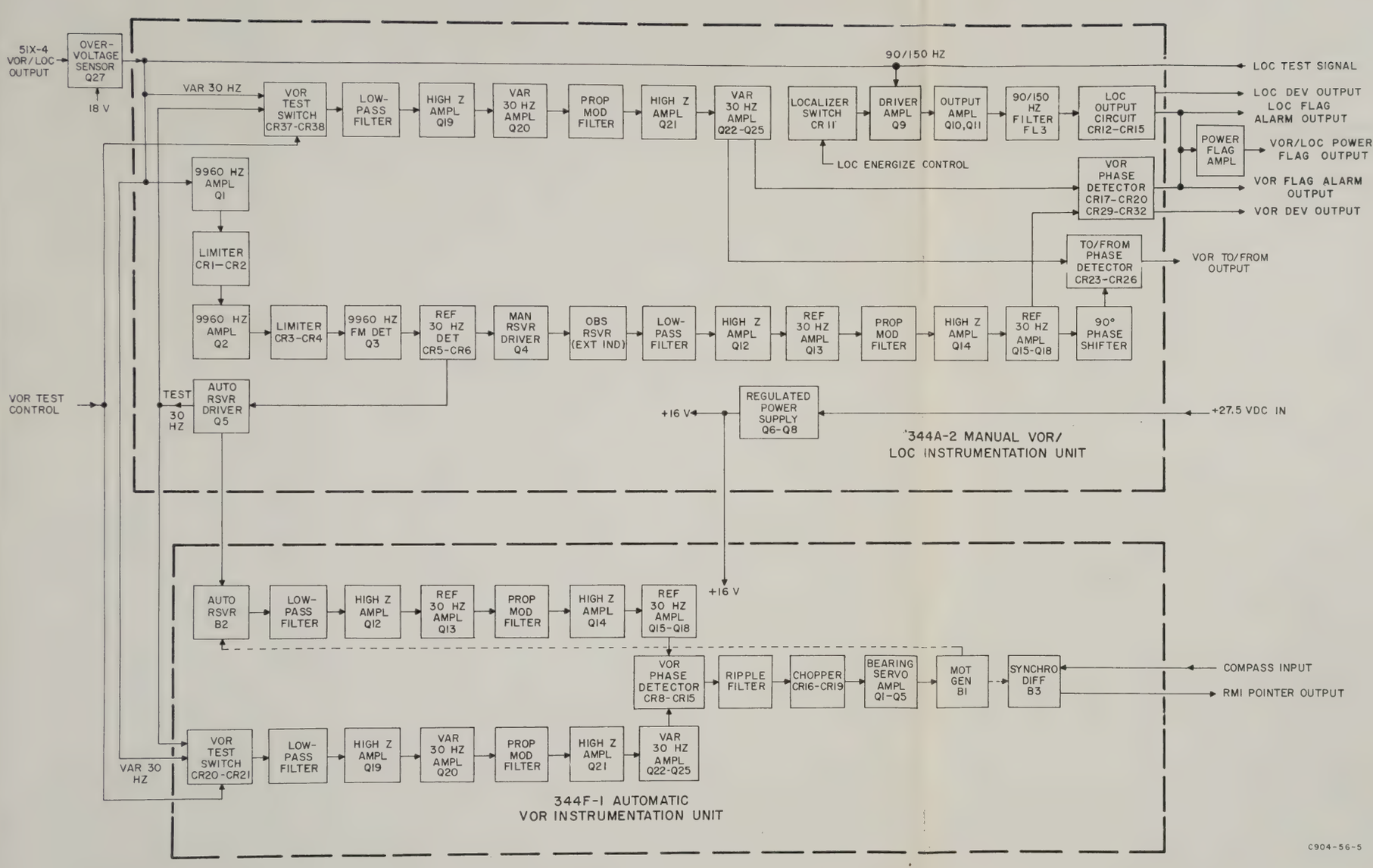

HZ
LOC TEST SIGNAL
OUTPUT AMPL Q10,Q11
90/150 HZ FILTER FL3
LOC OUTPUT CIRCUIT CR12-CR15
LOC DEV OUTPUT
LOC FLAG ALARM OUTPUT
POWER FLAG AMPL
VOR/LOC POWER FLAG OUTPUT
CONTROL
VOR PHASE DETECTOR CR17-CR20 CR29-CR32
VOR FLAG ALARM OUTPUT
VOR DEV OUTPUT
6 V
TO/FROM PHASE DETECTOR CR23-CR26
VOR TO/FROM OUTPUT
HIGH Z AMPL Q14
REF 30 HZ AMPL Q15-Q18
90° PHASE SHIFTER
+27.5 VDC IN
4A-2 MANUAL VOR/ INSTRUMENTATION UNIT
MOT GEN B1
SYNCHRO DIFF B3
COMPASS INPUT
RMI POINTER OUTPUT

C904-56-5

51RV-1 VOR/ILS Receiver - Trouble Shooting

1. GENERAL.

To determine if the 51RV-1 is operating properly, perform the procedures presented in the adjustment/test section of this manual.



51RV-1 Block Diagram (Sheet 2 of 2)
Figure 12

51RV-1 VOR/ILS Receiver - Trouble Shooting

1. GENERAL.

To determine if the 51RV-1 is operating properly, perform the procedures presented in the adjustment/test section of this manual.

51RV-1 VOR/ILS Receiver - Servicing

1. GENERAL.

The 51RV-1 VOR/ILS Receiver does not require servicing other than the periodic tests outlined in the adjustment/test section of this manual.

51RV-1 VOR/ILS Receiver - Removal/Installation

1. INITIAL INSTALLATION.

A. General.

The 51RV-1 VOR/ILS Receiver requires no adjustment during flight, so it may be mounted in any convenient location. The antenna transmission lines should be as short as possible. The aircraft engine, ignition system, and generator should be bonded and shielded to prevent electrical interference.

B. Preinstallation Testing.

(1) General.

Once the equipment has been unpacked and checked for visible shipping damage, it should be subjected to a preinstallation bench test. The 51RV-1 is aligned and tested before leaving the factory, and no adjustments should be required unless repairs are made. The following check is intended to ensure correct operation of the 51RV-1 when installed in an aircraft if the interconnecting wiring is installed correctly. If the 51RV-1 fails to pass any of the tests presented in this section, refer to the overhaul manual for alignment and trouble-shooting information.

(2) Test Equipment Required.

Figure 401 lists the test equipment required for the preinstallation and preflight checks of the 51RV-1. If other test equipment is used, the test operator must be certain the substitute equipment is equivalent to that listed. The test equipment must be checked and calibrated per RTCA paper 208-53/DO-52.

ITEM	IDENTIFICATION
Test jig	To be locally fabricated (figure 402)
Signal generator	Boonton 211-A
6-db pad (included with 211-A and 232-A)	Boonton 505-B
Signal generator	Boonton 232-A
R-f cable (included with 211-A and 232-A)	Boonton 514-B

Table of Test Equipment Required (Sheet 1 of 2)
Figure 401

ITEM	IDENTIFICATION
Precision track selector	Collins 479V-2/3
Control	Collins 313N-1/2/3
Deviation meter	Weston 901 (1000 ohms, 1% accuracy, 150-0-150 microamperes)
Flag indicator	Weston 901 (modified to 1000 ohms, 1% accuracy, 0 to 500 ua)
Signal generator	Collins 479S-3
Vtvm (ac)	Hewlett-Packard 410B
Signal generator (ramp test set)	Collins 479T-2

Table of Test Equipment Required (Sheet 2 of 2)
Figure 401

(3) 51RV-1 Test Jig.

All parts required to construct the electrical portion of the test jig are shown symbolically in the schematic diagram, figure 402. Connectors P1, P2, P3, and P4 may be mounted on the test jig frame in a location to provide for direct mounting of the 51RV-1, 479V-2/3, RMI, and 313N-1/2/3. If it is desired to separate the equipment from the test jig, all the wires attached to the connectors should be lengthened to form pendant cables. Place sleeving over each set of wires and run each set through a rubber grommet in the test jig frame.

(4) Test Setup and Performance Check. (Refer to figures 402 and 403.)

(a) Connect P1 of the test jig to the rear connector on the 51RV-1.

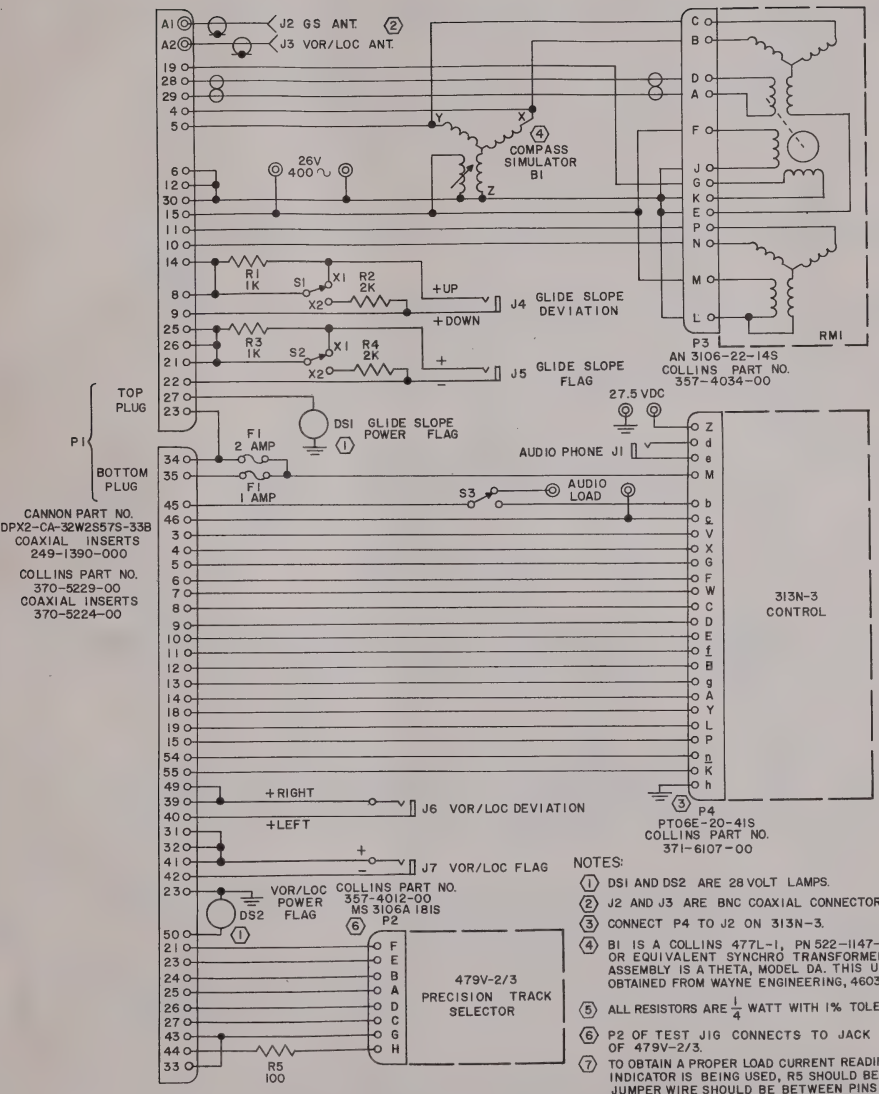
(b) Connect the deviation meter to the VOR/LOC DEVIATION jack and the flag meter to the VOR/LOC FLAG jack on the test jig.

(c) Connect P2 on the test jig to the 479V-2/3 and P4 on the test jig to J2 on the 313N-2/3, or J1 on the 313N-1.

(d) Apply 26-volt, 400-Hz, and 27.5-volt dc power to the test jig power connectors.

(e) Connect the 211-A EXT MOD connector to the 479S-3 MOD OUTPUT connector and the 211-A RF OUT connector to the test jig VOR/LOC ANT jack J3.

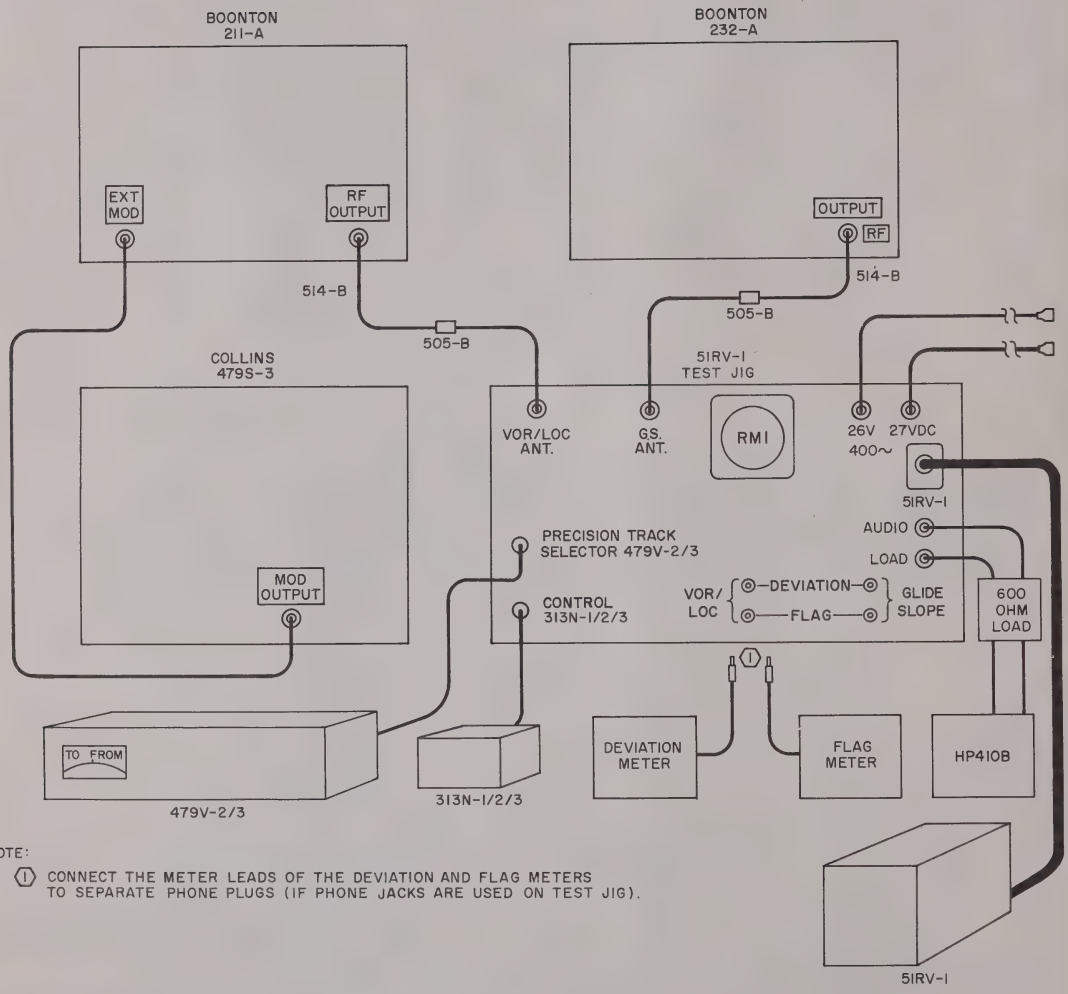
(f) Set the 313N-1/2/3 NAV frequency to 114.90 MHz and NAV power switch to PWR. Set the 479S-3 and 211-A power switches to ON. Allow 15 minutes for equipment warmup.



NOTES:

1. DS1 AND DS2 ARE 28 VOLT LAMPS.
2. J2 AND J3 ARE BNC COAXIAL CONNECTORS.
3. CONNECT P4 TO J2 ON 313N-3.
4. B1 IS A COLLINS 477L-1, PN 522-1147-004, OR EQUIVALENT SYNCHRO TRANSFORMER. DIAL ASSEMBLY IS A THETA, MODEL DA. THIS UNIT MAY BE OBTAINED FROM WAYNE ENGINEERING, 4603 W. MAIN ST., SKOKIE, ILL.
5. ALL RESISTORS ARE $\frac{1}{4}$ WATT WITH 1% TOLERANCE
6. P2 OF TEST JIG CONNECTS TO JACK J OF 479V-2/3.
7. TO OBTAIN A PROPER LOAD CURRENT READING WHEN ONE TO-FROM INDICATOR IS BEING USED, R5 SHOULD BE IN THE CIRCUIT AND JUMPER WIRE SHOULD BE BETWEEN PINS 33 AND 43.

51RV-1 VOR/ILS Receiver Test Jig, Schematic Diagram
Figure 402



NOTE:

(1) CONNECT THE METER LEADS OF THE DEVIATION AND FLAG METERS TO SEPARATE PHONE PLUGS (IF PHONE JACKS ARE USED ON TEST JIG).

51RV-1 Preinstallation Test Setup Diagram
Figure 403

(g) Set the 211-A MOD switch to EXT, the OSC SEL to XTAL, the XTAL switch to 114.9 MC, and tune the frequency control to obtain a maximum indication on the RF MONITOR meter. Set the 211-A RF LEVEL control for a red-line indication on this meter.

(h) Ensure that the 479S-3 is properly calibrated, and set the FUNCTION SELECTOR to CAL SIGNAL and the SPECIFIC SIGNAL SELECTOR to 9960 FM.

(i) Adjust the 211-A MOD LEVEL control for 30-percent modulation on the PER CENT MODULATION meter.

NOTE: The modulation should be 30 percent when the 479S-3 SPECIFIC SIGNAL SELECTOR is set to 30~VAR Ø.

(j) Set the 211-A output level to 100 microvolts, the 479S-3 FUNCTION SELECTOR to ODR, the 479S-3 PHASE ANGLE SELECTOR to 270, and the 479V-2/3 BEARING DEGREES control to 90.

(k) The deviation meter reading should be 0 ±12 microamperes, the flag meter reading should be 300 ±16 microamperes, the RMI indication should be 90 ±2 degrees, and the 479V-2/3 TO-FROM meter should register a TO indication. Set the 479V-2/3 BEARING DEGREES control to 270. The TO-FROM meter should register a FROM indication.

NOTE: Current should be 1100 ±400 microamperes if current through one 100-ohm to/from load is measured. If current through two parallel 200-ohm loads is measured, it should be 700 ±200 microamperes each.

(l) Set the 479V-2/3 BEARING DEGREES control to 90 and the 479S-3 PHASE ANGLE SELECTOR to 279. The deviation meter reading should be 135 ±10 microamperes to the right.

(m) Set the 211-A XTAL switch to 110.1 MC and adjust the frequency control to obtain a maximum indication on the RF MONITOR meter. Set the RF LEVEL control to obtain an indication on this meter at the red line, and set the output level to 1000 microvolts.

(n) Set the 313N-1/2/3 NAV frequency to 110.10 mc, the 479S-3 FUNCTION SELECTOR to TONE LOC, and the TONE LOCALIZER control to CAL 150~. Adjust the 211-A MOD LEVEL control for a 20-percent modulation on the PERCENT MODULATION meter.

NOTE: The modulation should be 20 percent when the 479S-3 TONE LOCALIZER control is set to CAL 90~.

(o) Set the 479S-3 TONE LOCALIZER CONTROL to 0. The deviation meter indication should be 0 to ±3 microamperes, and the flag meter indication should be 375 ±18 microamperes.

(p) Set the 479S-3 TONE LOCALIZER control to 4 DB on the left (150 cps stronger than 90 cps). The deviation meter reading should be 90 ±5 microamperes to the left. Set the TONE LOCALIZER control to 4 DB on the right (90 cps stronger than 150 cps). The deviation meter reading should be 90 ±5 microamperes to the right.

(q) The RMI needle should point to the right.

(r) Connect a 600-ohm load across the test jig AUDIO LOAD terminals and connect the HP-410B across the 600-ohm load. Ensure the 211-A is properly calibrated, set the MOD switch to 1000, and the RF LEVEL to 1000 microvolts. The voltage across the 600-ohm load should be approximately 7 volts.

(s) Set the 313N-( ) frequency to 114.90 MHz, the 211-A MOD switch to EXT, the XTAL switch to 114.9 MC, and adjust the frequency control to obtain a red-line indication on the meter. Adjust the 211-A MOD LEVEL control to reduce the percent modulation until the VOR/LOC power flag light goes out. The VOR/LOC flag current should be 230 +10, -5 microamperes. (The VOR/LOC flag current for the -020 status should be 245 ±5 microamperes.)

(t) Connect the deviation meter to the test jig GLIDE SLOPE DEVIATION jack and the flag meter to the GLIDE SLOPE flag jack. The deviation current should be 1200 ±200 microamperes and the flag current should be 2000 ±400 microamperes.

(u) Set the 313N-( ) NAV frequency to 109.3 (localizer frequency paired with glideslope frequency of 332.0 megahertz). Connect the 232-A RF OUTPUT to the test jig G.S. ANT connector, set the 232-A POWER to ON, set the 232-A FREQUENCY to 332.0 MHz, set the 232-A OUTPUT LEVEL to 700 microvolts, set the 232-A MOD switch to 90-150, and set the 232-A TONE RATIO control to 0. The deviation meter reading should be 0 ±4 microamperes and the flag meter reading should be 350 ±25 microamperes.

(v) Set the 232-A TONE RATIO control to 2.0 on the left (90 Hz stronger than 150 Hz). The deviation meter reading should be 78 ±8 microamperes to the left. The deviation should be the same value, but to the right when the TONE RATIO control is set to 2.0 on the right (150 Hz stronger than 90 Hz).

(w) Set the 232-A OUTPUT LEVEL to 700 microvolts and reduce the modulation percentage until the glideslope power flag goes out. The flag meter reading should be 230 +10, -5 microamperes. (The flag meter reading for the -020 status should be 245 ±5 microamperes.)

(5) 51RV-1 Bias and Damping Circuits, Removal Procedures.

(a) The 51RV-1 VOR/ILS Receiver is equipped with bias circuits which will give a full UP indication on the glideslope pointer and retract the glideslope flag when a VOR frequency is selected. The bias system is designed to work with the Collins 329B-6 series approach horizon and the 331A-6 and 331A-7 series course indicator. This feature is factory installed, but is arranged for easy removal if desired. To take out the bias system, remove the jumper wire connecting R7 with the terminal directly above R7 in the 51RV-1 frame. See figure 404 for location of R7.

(b) The 51RV-1 VOR/ILS Receiver contains damping capacitors which can be removed if the damping is not desired. The following describes all the damping circuits and how they can be removed. See figure 404 for location and identification of components.

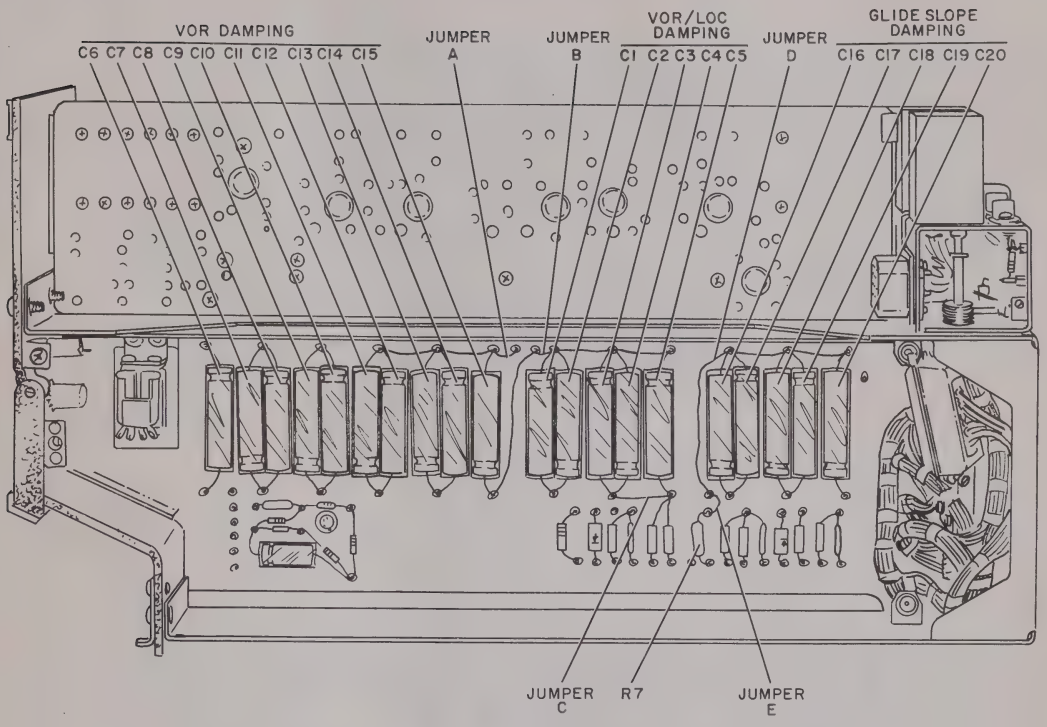
1. To remove the deviation indicator damping, which is added when switching from ILS to VOR, remove jumper A.

2. To remove the VOR/LOC damping, remove jumper B.

   NOTE: At lest one capacitor, whether internal or external, must remain in the circuit at all times or bearing error will result.

3. To remove all internal VOR/LOC damping, remove jumpers A and B. Individual capacitors can be taken out to remove part of the damping. Do not remove jumper C.

4. To remove glideslope damping, remove jumper D.



51RV-1 Biasing and Damping Component Locations
Figure 404

(c) The 51RV-1 VOR/ILS Receiver contains a bias system that automatically positions the RMI pointer to a position corresponding to 3 o'clock (toward the right wing of the aircraft) when the NAV receiver is tuned to localizer frequencies. This circuitry is in the 344F-1 Automatic VOR Instrumentation Unit. The following steps describe how this bias system can be removed, if desired. See figure 405 for location of components.

1. Remove diode CR2 and capacitor C56.

2. Remove resistors R19 and R20.

3. Remove three screws holding in the amplifier assembly, on the right side of the 344F-1, and fold assembly out. Remove screw holding TB1 and rotate up as shown in figure 405. Replace R21 with a jumper wire or, if desired, jumper across R21.

4. Connect the anode end of diode CR2 (or any 1N457 diode) to the base of transistor Q2 and connect the cathode end to terminal A.

After all wiring to the mount connector is complete (the connector may be removed from the mount for wiring), place the 51RV-1 on the mount. Secure the 51RV-1 to the mount by tightening the mount thumb nuts over the 51RV-1 projection hooks.

D. Cabling.

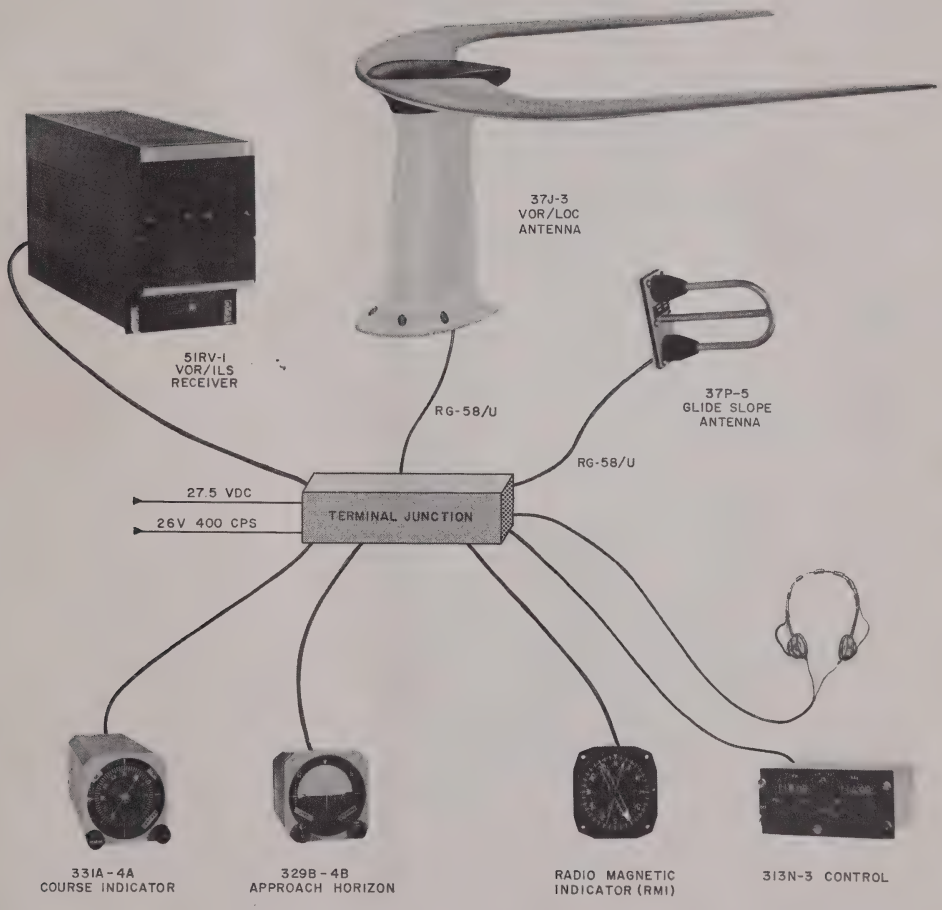
Figure 407 shows the cabling diagram of a typical 51RV-1 installation. Point-to-point interconnections between the 51RV-1 and associated equipment shown in this diagram are given in figure 408. All interconnection instructions given in the notes of figure 408 should be followed carefully. Compass no. 1 and compass no. 2 can be connected to a common power source. If each compass has a separate power source, see notes 8 and 9 of figure 408 for proper connections with VOR bearing pointer and compass card synchro motor. If the 3 o'clock (right wing point) bias circuitry has been removed, TP15 need not be connected to the power supplying compass no. 1 and RMI pointer as shown in figure 408. All 51RV-1 connections are made on its mating connector, which is located in the 390Y-1 or on an ARINC rack in the aircraft. Figure 406 lists the connectors used.

The 344F-1 Automatic VOR Instrumentation Unit has provisions for easy installation of an RMI servo amplifier. Remove the dummy amplifier from the 344F-1 chassis. Solder the red, blue, white, green, and yellow wires of the servo amplifier to terminals E51, E52, E53, E54, and E55 respectively. Mount the amplifier chassis where the dummy chassis was removed.

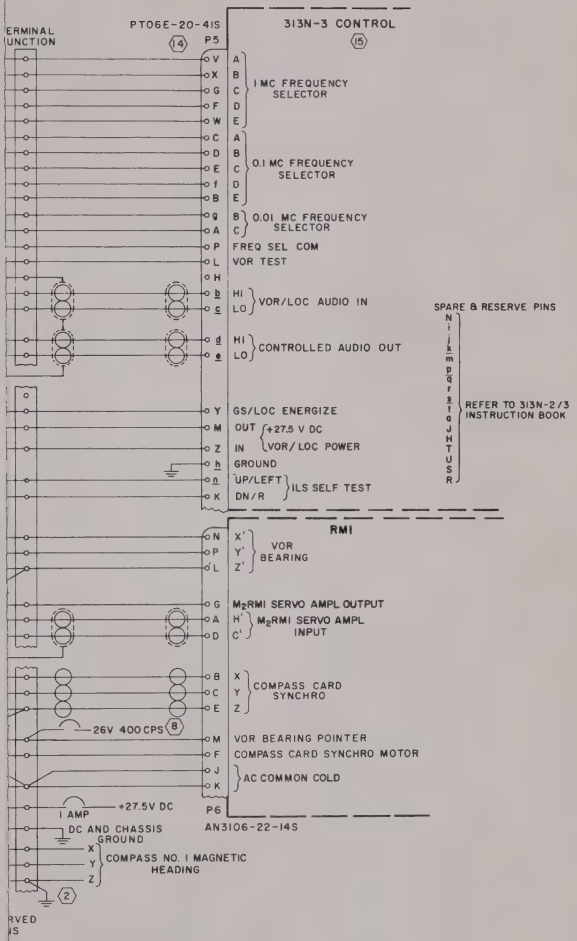
The 51RV-1 will drive five VOR/LOC deviation indicators, five glideslope deviation indicators, four VOR/LOC flag indicators, four glideslope flag indicators, and two TO-FROM indicators. Connections shown in figure 408 are given for connecting two external loads to each deviation and each flag output, and one external load for the TO-FROM output. Figure 409 lists the jumpers required for other load configurations. Attach the jumpers to the mount connector to correspond with the number of external loads used for each function. If equipment other than that shown in figures 407 and 408 is used, refer to figure 410 for the functions of the 51RV-1 connector pins.

EQUIPMENT	EQUIPMENT CONNECTOR		MATING CONNECTOR			CABLE CLAMP
	DESIGNATION	TYPE	SYMBOL	TYPE	COLLINS PART NUMBER	
331A-4A	J2	PB02A-18-32PY	P2	PB06E-18-32SY	371-1217-00	None required
329B-4B	J1	PB02A-18-32P	P3	PB06E-18-32S	371-1214-00	None required
51RV-1	51RV-1 Rear Connector 370-5233-00	DPX2-CA-32W2P 57P-34B	P4	DPX2-CA-32W2S 57S-33B	370-5229-00	None required
		Cannon Coaxial Inserts 249-1384-000		Cannon Coaxial Inserts 249-1390-000	370-5224-00	None required
313N-3	J2	PT02A-20-41P	P5	PT06E-20-41S	371-6107-00	None required
RMI	Rear Connector	AN3102-22-14P	P6	AN3106-22-14S	357-4034-00	None required

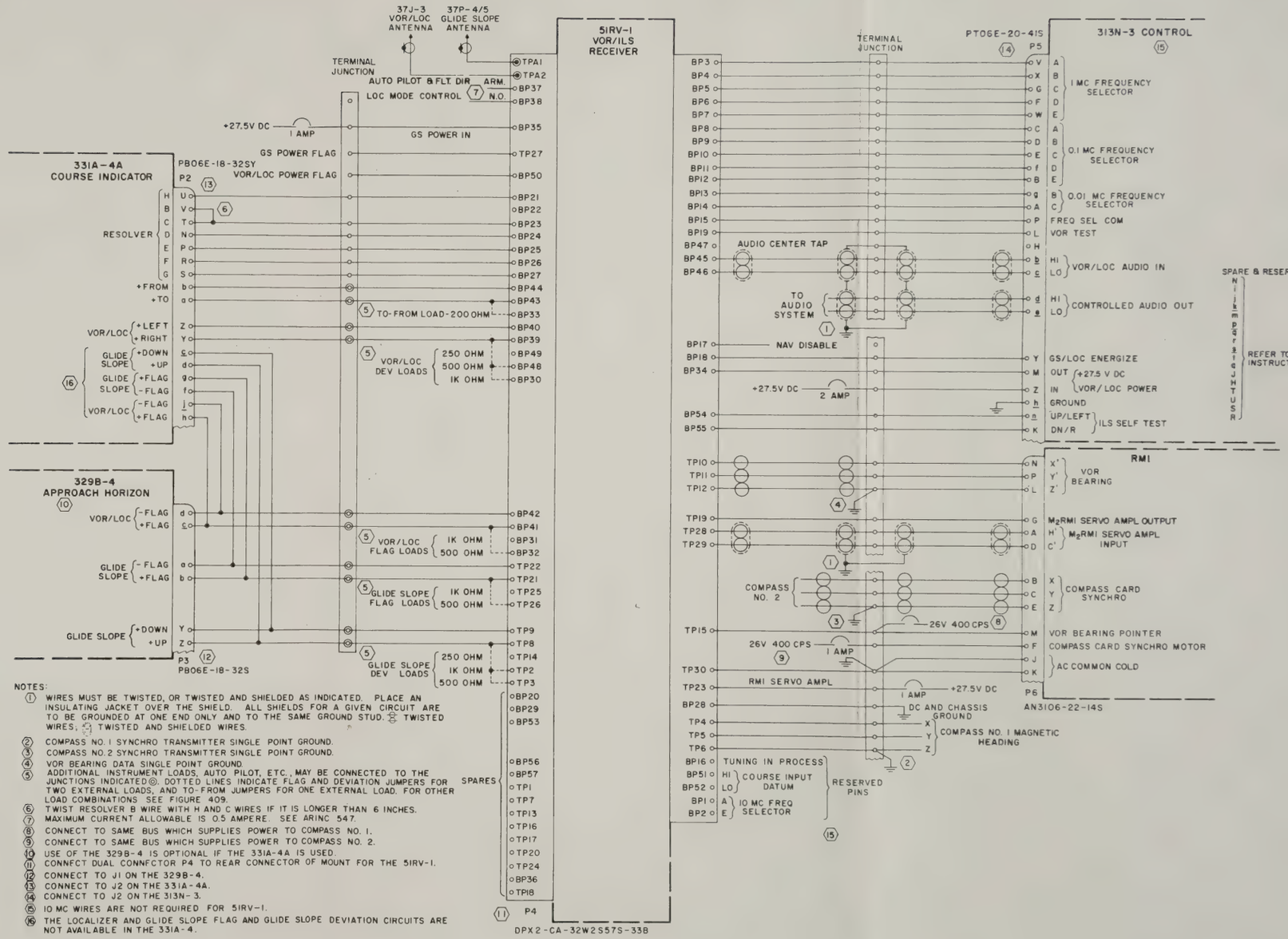
Connectors Used for Typical 51RV-1 Installation
Figure 406



51RV-1 Installation Cabling Diagram
Figure 407



51RV-1 Interconnection Wiring Diagram
Figure 408



NOTES:

1. WIRES MUST BE TWISTED, OR TWISTED AND SHIELDED AS INDICATED. PLACE AN INSULATING JACKET OVER THE SHIELD. ALL SHIELDS FOR A GIVEN CIRCUIT ARE TO BE GROUNDED AT ONE END ONLY AND TO THE SAME GROUND STUD. ⊛ TWISTED WIRES, ⊛ TWISTED AND SHIELDED WIRES.
2. COMPASS NO. 1 SYNCHRO TRANSMITTER SINGLE POINT GROUND.
3. COMPASS NO. 2 SYNCHRO TRANSMITTER SINGLE POINT GROUND.
4. VOR BEARING DATA SINGLE POINT GROUND.
5. ADDITIONAL INSTRUMENT LOADS, AUTO PILOT, ETC., MAY BE CONNECTED TO THE JUNCTIONS INDICATED ⊙. DOTTED LINES INDICATE FLAG AND DEVIATION JUMPERS FOR TWO EXTERNAL LOADS, AND TO-FROM JUMPERS FOR ONE EXTERNAL LOAD. FOR OTHER LOAD COMBINATIONS SEE FIGURE 409.
6. TWIST RESOLVER B WIRE WITH H AND C WIRES IF IT IS LONGER THAN 6 INCHES.
7. MAXIMUM CURRENT ALLOWABLE IS 0.5 AMPERE. SEE ARINC 547.
8. CONNECT TO SAME BUS WHICH SUPPLIES POWER TO COMPASS NO. 1.
9. CONNECT TO SAME BUS WHICH SUPPLIES POWER TO COMPASS NO. 2.
10. USE OF THE 329B-4 IS OPTIONAL IF THE 331A-4A IS USED.
11. CONNECT DUAL CONNECTOR P4 TO REAR CONNECTOR OF MOUNT FOR THE 51RV-1.
12. CONNECT TO J1 ON THE 329B-4.
13. CONNECT TO J2 ON THE 331A-4A.
14. CONNECT TO J2 ON THE 313N-3.
15. 10 MC WIRES ARE NOT REQUIRED FOR 51RV-1.
16. THE LOCALIZER AND GLIDE SLOPE FLAG AND GLIDE SLOPE DEVIATION CIRCUITS ARE NOT AVAILABLE IN THE 331A-4.

51RV-1 Interconnection Wiring Diagram
Figure 408

Feb 15/64

FUNCTION	51RV-1 TERMINALS	NUMBER OF EXTERNAL LOADS				
		1	2	3	4	5
Glide slope deviation	TP-8 TP-2 1K TP-3 500 TP-14 250 TP-9	Short TP-8 to TP-14	Short TP-8 to TP-2 and TP-3	Short TP-8 to TP-3	Short TP-8 to TP-2	No jumper required
Glide slope flag	TP-21 TP-25 1K TP-26 500 TP-22	Short TP-21 to TP-25 and TP-26	Short TP-21 to TP-26	Short TP-21 to TP-25	No jumper required	
VOR/LOC deviation	BP-39 BP-30 1K BP-48 500 BP-49 250 BP-40	Short BP-39 to BP-49	Short BP-39 to BP-30 and BP-48	Short BP-39 to BP-48	Short BP-39 to BP-30	No jumper required
VOR/LOC flag	BP-41 BP-31 1K BP-32 500 BP-42	Short BP-41 to BP-31 and BP-32	Short BP-41 to BP-32	Short BP-41 to BP-31	No jumper required	
TO-FROM	BP-44 BP-33 200 BP-43	Short BP-43 to BP-33	No jumper required			

Table of Jumpers Required for 51RV-1 Deviation and Flag Loads
Figure 409

Figure 410 lists the functions for all pins on the 51RV-1 connector. The bottom plug is designated as BP and the top plug is designated as TP.

PIN NO.	FUNCTION	PIN NO.	FUNCTION
BP-1	A wire } 10-mc frequency selector	BP-8	A wire } .1-mc frequency selector
BP-2	B wire }	BP-9	B wire
BP-3	A wire } 1-mc frequency selector	BP-10	C wire
BP-4	B wire	BP-11	D wire
BP-5	C wire	BP-12	E wire
BP-6	D wire	BP-13	B wire } .01-mc frequency selector
BP-7	E wire	BP-14	C wire }

Table of 51RV-1 Connector Pin Functions (Sheet 1 of 3)
Figure 410

PIN NO.	FUNCTION
BP-15	D-c and chassis ground
BP-16	Tuning in process
BP-17	Nav disable
BP-18	GS/LOC energize
BP-19	VOR test
BP-20	Future spare
BP-21	H wire
BP-22	B wire
BP-23	C wire
BP-24	D wire
BP-25	E wire
BP-26	F wire
BP-27	G wire
	(BP-21 through BP-27: Course Resolver)
BP-28	D-c and chassis ground
BP-29	Future spare
BP-30	1K VOR/LOC dev load
BP-31	1K
BP-32	500 ohm
	(BP-31, BP-32: VOR/LOC flag loads)
BP-33	To/From load - 200 ohms
BP-34	VOR/LOC 27.5 volts d-c power in
BP-35	In
BP-36	Out
	(BP-35, BP-36: 27.5 volts d-c glide slope power)
BP-37	Arm
BP-38	N.O.
	(BP-37, BP-38: Flight dir LOC mode control)
BP-39	+ Right
BP-40	+ Left
BP-41	+ Flag
BP-42	- Flag
	(BP-39 through BP-42: VOR/LOC deviation)
BP-43	+ To
BP-44	+ From
BP-45	Hi
BP-46	Lo
BP-47	C.T.
	(BP-45 through BP-47: Aural output)

PIN NO.	FUNCTION
BP-48	500 ohm
BP-49	250 ohm
	(BP-48, BP-49: VOR/LOC deviation load)
BP-50	High power VOR/LOC flag
BP-51	Hi
BP-52	Lo
	(BP-51, BP-52: Reserved course datum)
BP-53	Spare
BP-54	ILS test UP/LEFT
BP-55	ILS test DOWN/RIGHT
	(BP-54, BP-55: Self-test)
BP-56	Spare
BP-57	Spare
TP-A1	Glide slope antenna
TP-A2	VOR/LOC antenna
TP-1	Future spare
TP-2	1000 ohm
TP-3	500 ohm
	(TP-2, TP-3: Glide slope deviation load)
TP-4	X
TP-5	Y
TP-6	Z
	(TP-4 through TP-6: Magnetic heading)
TP-7	Future spare
TP-8	+ Up
TP-9	+ Down
	(TP-8, TP-9: Glide slope deviation)
TP-10	X' wire
TP-11	Y' wire
TP-12	Z' wire
	(TP-10 through TP-12: VOR bearing)
TP-13	Future spare
TP-14	250-ohm glide slope deviation load
TP-15	26-volt a-c input
TP-16	Future spare

Table of 51RV-1 Connector Pin Functions (Sheet 2 of 3)
Figure 410

PIN NO.	FUNCTION	PIN NO.	FUNCTION
TP-17	Future spare	TP-25	1000 ohms } Glide slope flag
TP-18	Suggested spare	TP-26	500 ohms } load
TP-19	M2 RMI servo ampl out		
TP-20	Future spare	TP-27	High pwr GS flag
TP-21	+ } Glide slope flag	TP-28	H' } RMI servo ampl in
TP-22	- }	TP-29	C' }
TP-23	27.5 volts d-c RMI servo ampl		
TP-24	Future spare	TP-30	A-c common

Table of 51RV-1 Connector Pin Functions (Sheet 3 of 3)
Figure 410

2. REPLACEMENT PROCEDURES.

A. Removal.

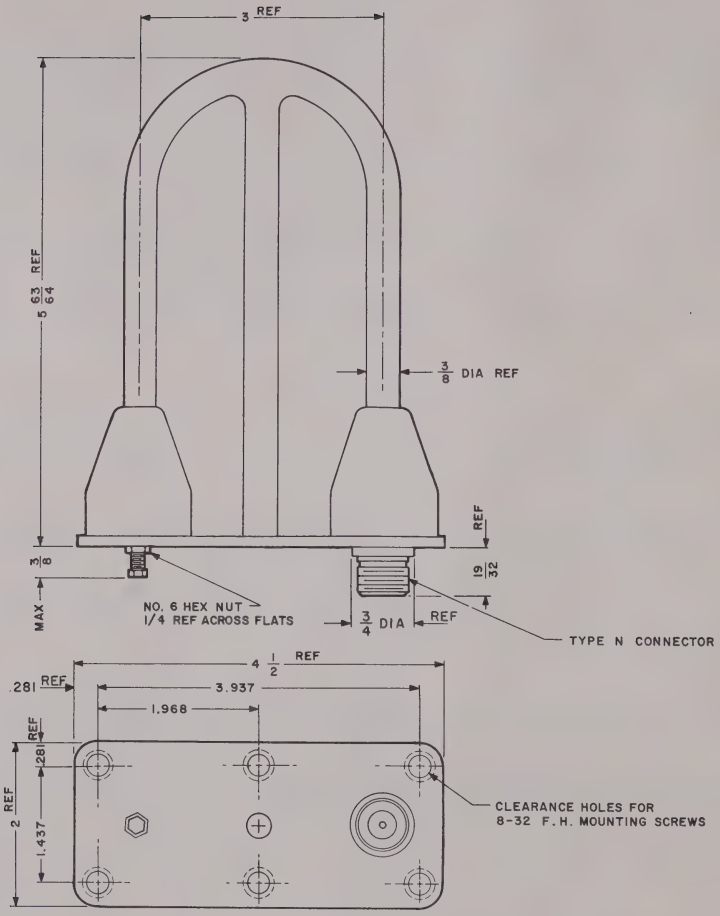
(1) Loosen the knurled retainer nuts on the front of the mount until the hold-down clamps can be slipped off the lugs on the front of the 51RV-1.

(2) Slide the 51RV-1 straight out of its mount.

B. Replacement.

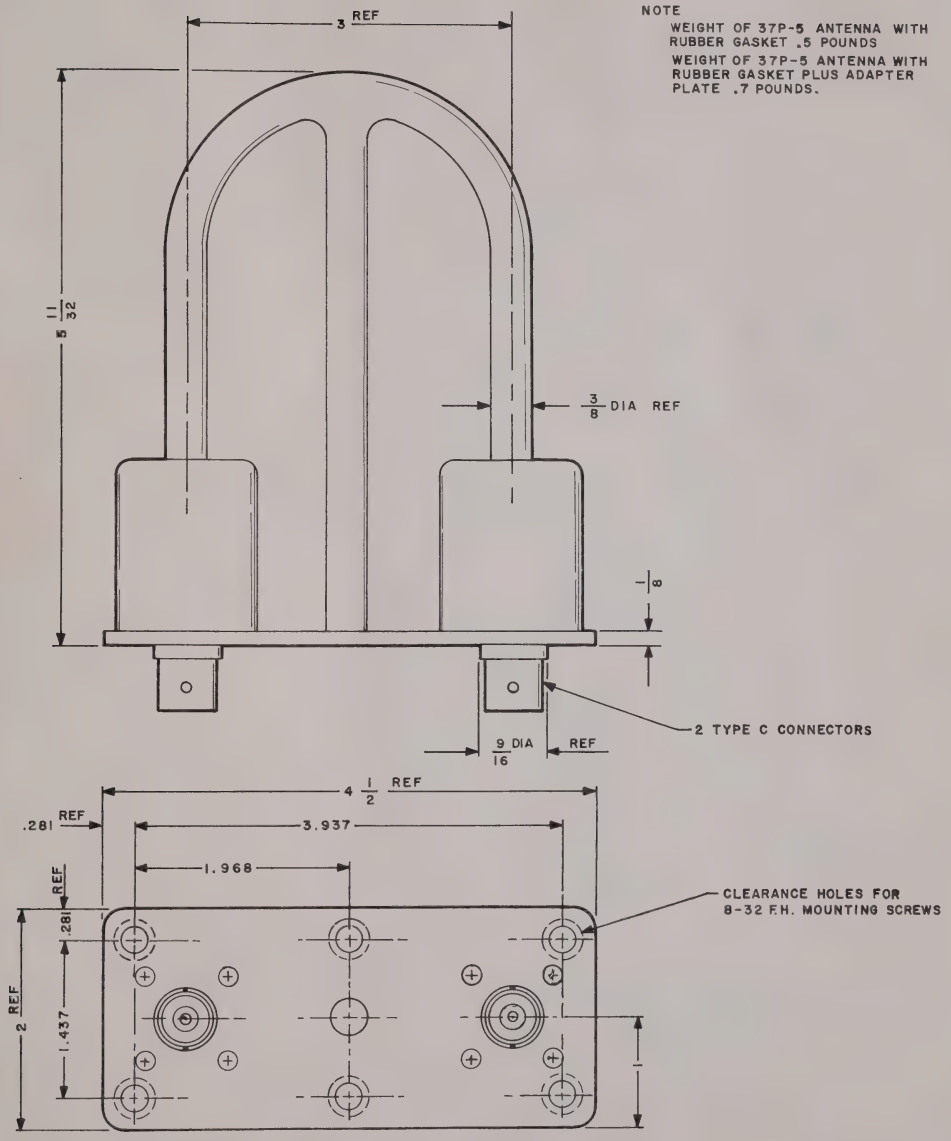
(1) Place the 51RV-1 on the mount and push toward the rear until the connector on the rear of the 51RV-1 is mated with receptacle in the mount.

(2) Place the hold-down clamps of the mount over the lug on the front of the 51RV-1. Tighten the knurled retainers until the 51RV-1 is secure.

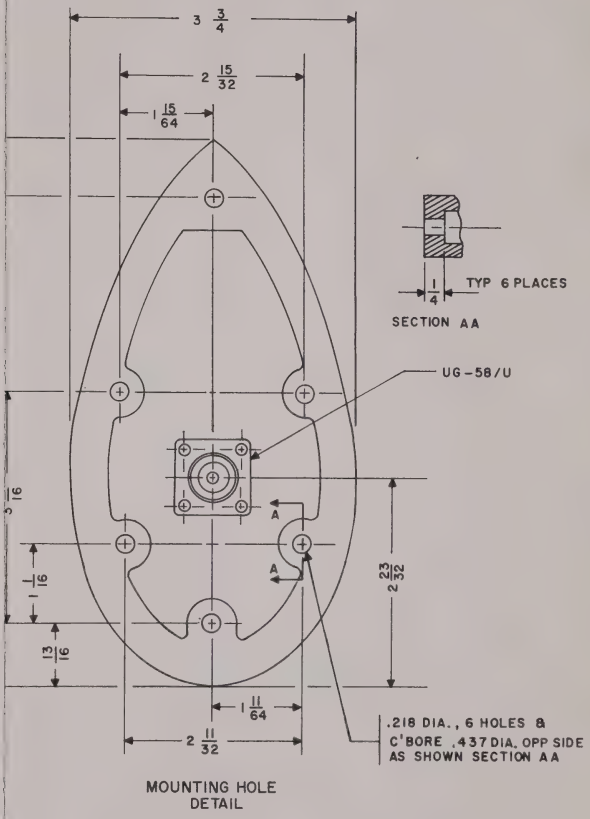


WEIGHT OF 37P-4 ANTENNA WITH RUBBER GASKET. — .5 POUNDS
WEIGHT OF 37P-4 ANTENNA WITH RUBBER GASKET
PLUS ADAPTER PLATE. — .7 POUNDS

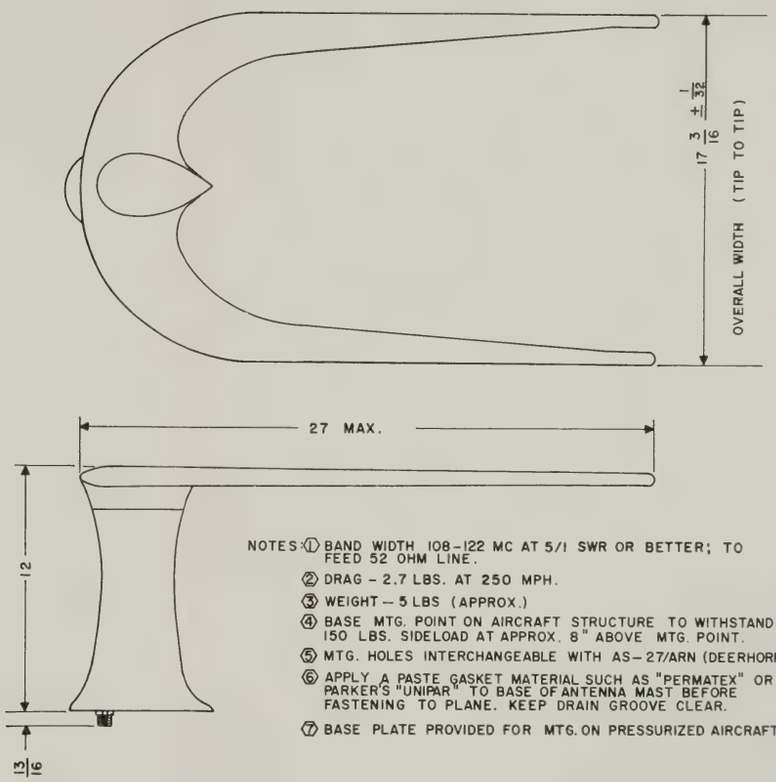
37P-4 Glide Slope Antenna, Outline and Mounting Dimensions
Figure 411

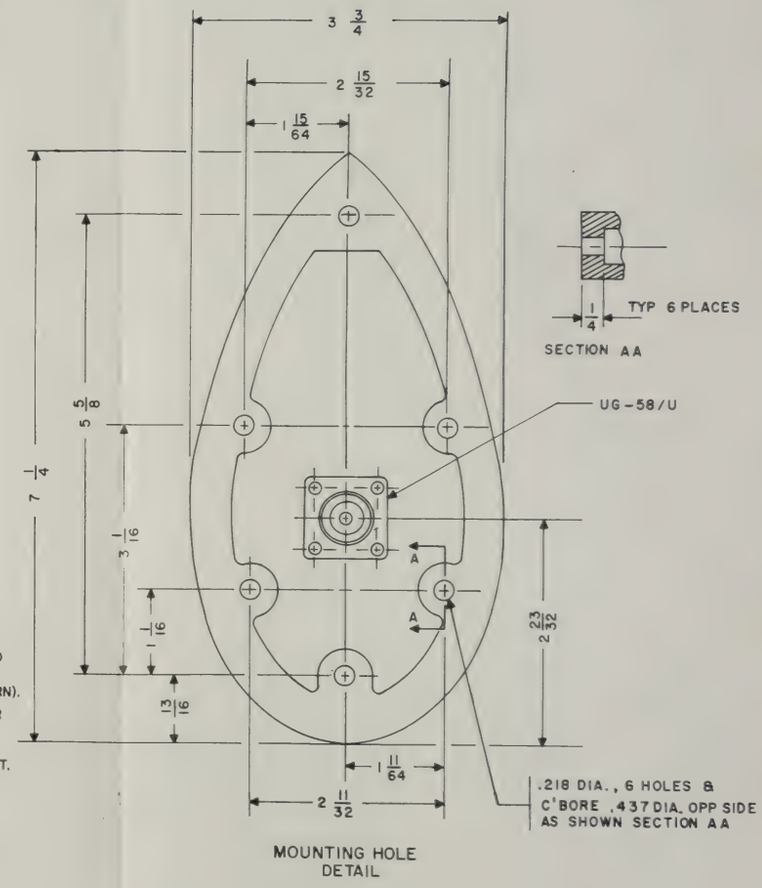


37P-5 Glide Slope Antenna, Outline and Mounting Dimensions
Figure 412



37J-3 VOR/LOC Antenna, Outline and
Mounting Dimensions
Figure 413


17 3/16 ± 1/32
OVERALL WIDTH (TIP TO TIP)
27 MAX.
12
13/16
NOTES: ① BAND WIDTH 108-122 MC AT 5/1 SWR OR BETTER; TO FEED 52 OHM LINE.
② DRAG - 2.7 LBS. AT 250 MPH.
③ WEIGHT - 5 LBS (APPROX.)
④ BASE MTG. POINT ON AIRCRAFT STRUCTURE TO WITHSTAND 150 LBS. SIDELOAD AT APPROX. 8" ABOVE MTG. POINT.
⑤ MTG. HOLES INTERCHANGEABLE WITH AS-27/ARN (DEERHORN).
⑥ APPLY A PASTE GASKET MATERIAL SUCH AS "PERMATEX" OR PARKER'S "UNIPAR" TO BASE OF ANTENNA MAST BEFORE FASTENING TO PLANE. KEEP DRAIN GROOVE CLEAR.
⑦ BASE PLATE PROVIDED FOR MTG. ON PRESSURIZED AIRCRAFT.

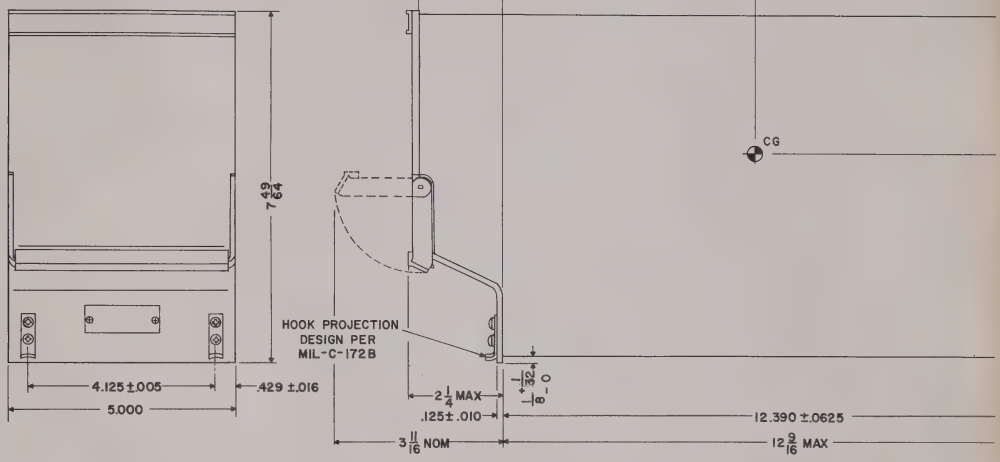


37J-3 VOR/LOC Antenna, Outline and
Mounting Dimensions
Figure 413

NOTES:
1. OUTLINE AND INSTALLATION DATA GIVEN IS IN ACCORDANCE WITH ARINC CHARACTERISTIC NO. 404
2. THE CASE MAY BE MOUNTED ON AN ATR RACK WITH SPRING LOADED HOLD DOWN PINS AND MATING DPX2 CONNECTOR:

COLLINS PART NO. { CONNECTOR; 370-5229-00; 2 COAXIAL INSERTS; 370-5224-00

CANNON PART NO. { CONNECTOR; DPX2-CA-32W2S57S-338-0002; 2 COAXIAL INSERTS; 249-1390-000



TYPE NO.	COLLINS PART NUMBER
51RV-1	522-2450-00 522-2450-011 522-2450-012 522-2450-013 522-2450-014 522-2450-015 522-2450-016 522-2450-018 522-2450-020

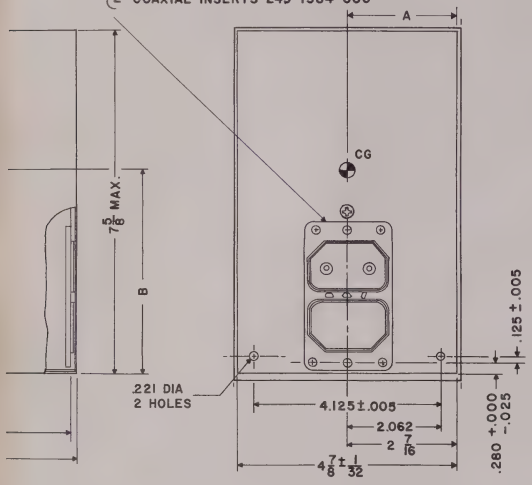
DIM.	51RV-1
A	2 7/16
B	4 1/8
C	5 1/16

51RV-1 VOR/ILS Receiver, Outline and Mounting Dimensions
Figure 414

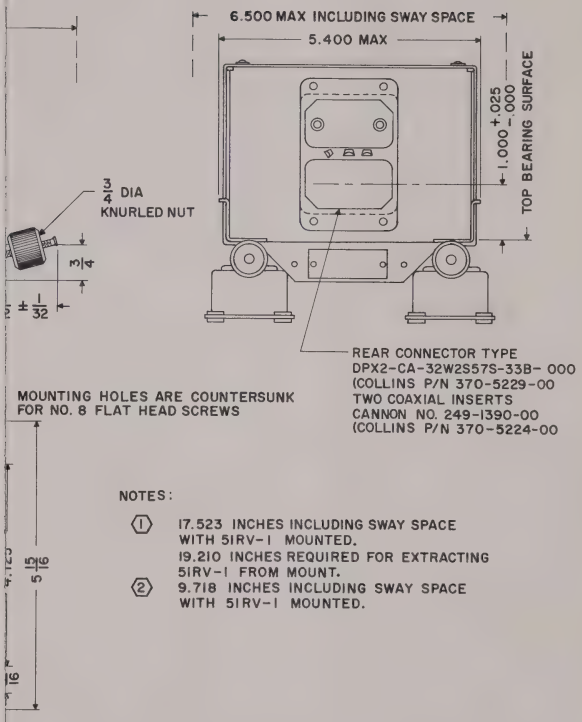
)PX2 CONNECTOR:

IS PART NO. { CONNECTOR 370-5234-00
2 COAXIAL INSERTS 370-5221-00

)N PART NO. { CONNECTOR DPX2-CA-32W2P57P-34B-0002
2 COAXIAL INSERTS 249-1384-000



51R-6
$2\frac{11}{16}$
$3\frac{5}{8}$
$5\frac{1}{16}$



390Y-1 Shockmount, Outline and
Mounting Dimensions
Figure 415

NOTES:
1. OUTLINE AND INSTALLATION DATA GIVEN IS IN ACCORDANCE WITH ARINC CHARACTERISTIC NO. 404
2. THE CASE MAY BE MOUNTED ON AN ATR RACK WITH SPRING LOADED HOLD DOWN PINS AND MATING DPX2 CONNECTOR:

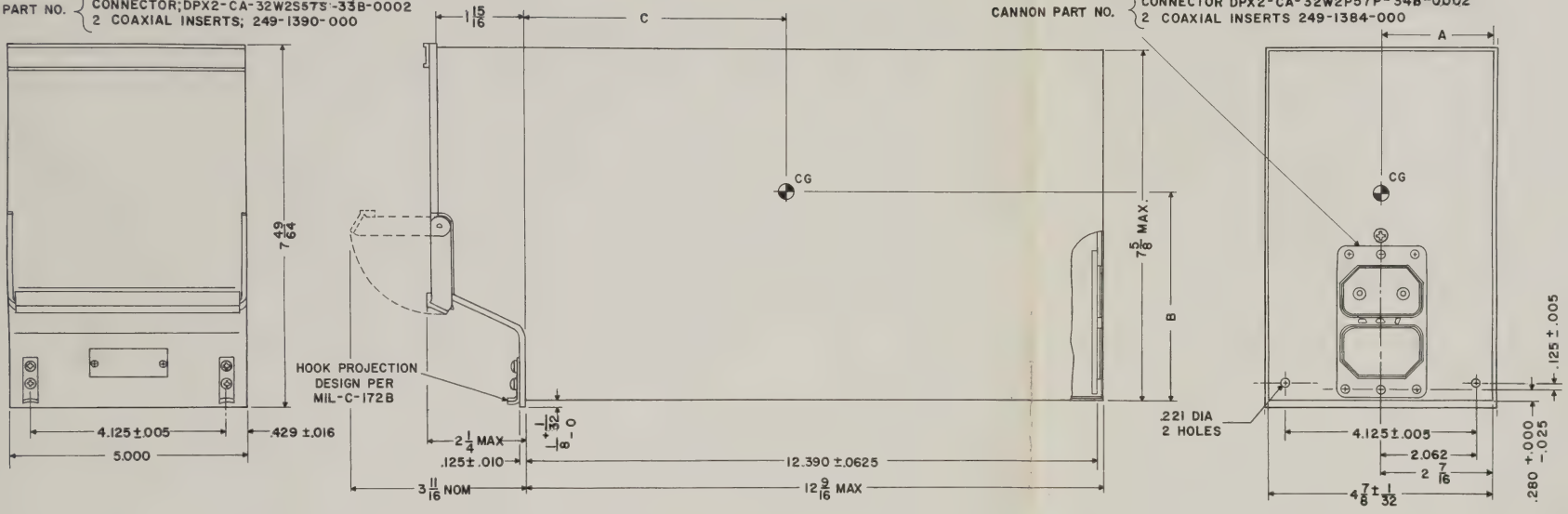
COLLINS PART NO. { CONNECTOR; 370-5229-00; 2 COAXIAL INSERTS; 370-5224-00

CANNON PART NO. { CONNECTOR; DPX2-CA-32W2S57S-33B-0002; 2 COAXIAL INSERTS; 249-1390-000

TYPE DPX2 CONNECTOR:

COLLINS PART NO. { CONNECTOR 370-5234-00; 2 COAXIAL INSERTS 370-5221-00

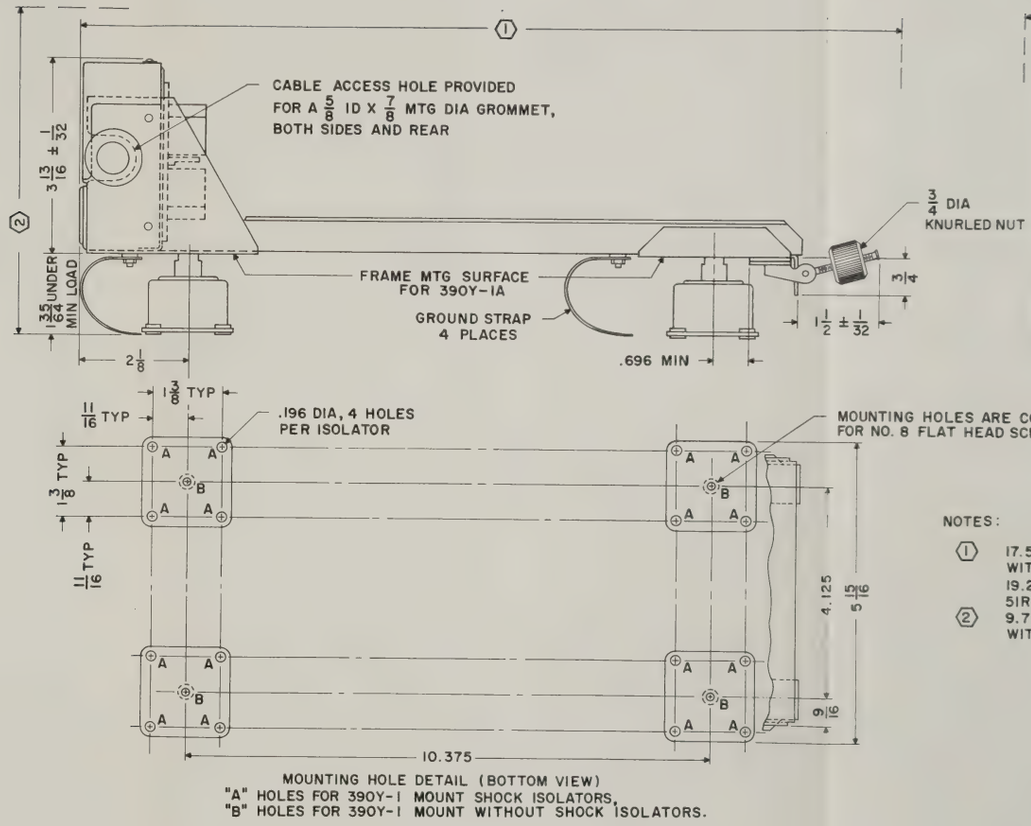
CANNON PART NO. { CONNECTOR DPX2-CA-32W2P57P-34B-0002; 2 COAXIAL INSERTS 249-1384-000



TYPE NO.	COLLINS PART NUMBER
51RV-1	522-2450-00 522-2450-011 522-2450-012 522-2450-013 522-2450-014 522-2450-015 522-2450-016 522-2450-018 522-2450-020

DIM.	51RV-1	51R-6
A	2 7/16	2 11/16
B	4 1/8	3 5/8
C	5 1/16	5 1/16

51RV-1 VOR/ILS Receiver, Outline and Mounting Dimensions
Figure 414


CABLE ACCESS HOLE PROVIDED FOR A 5/8 ID X 7/8 MTG DIA GROMMET, BOTH SIDES AND REAR
3 13/16 ± 1/32
1 35/64 UNDER MIN LOAD
2 1/8
FRAME MTG SURFACE FOR 390Y-1A
GROUND STRAP 4 PLACES
.696 MIN
1 1/2 ± 1/32
3/4
4 3/4 DIA KNURLED NUT
6.500 MAX INCLUDING SWAY SPACE
5.400 MAX
1.000 +.025 -.000
TOP BEARING SURFACE
REAR CONNECTOR TYPE DPX2-CA-32W2S57S-33B- 000 (COLLINS P/N 370-5229-00 TWO COAXIAL INSERTS CANNON NO. 249-1390-00 (COLLINS P/N 370-5224-00
1 3/8 TYP
11/16 TYP
3/16 TYP
11/16 TYP
.196 DIA, 4 HOLES PER ISOLATOR
MOUNTING HOLES ARE COUNTERSUNK FOR NO. 8 FLAT HEAD SCREWS
4.125
5 15/16
9/16
10.375
MOUNTING HOLE DETAIL (BOTTOM VIEW)
"A" HOLES FOR 390Y-1 MOUNT SHOCK ISOLATORS,
"B" HOLES FOR 390Y-1 MOUNT WITHOUT SHOCK ISOLATORS.

NOTES:

1. 17.523 INCHES INCLUDING SWAY SPACE WITH 51RV-1 MOUNTED.
   19.210 INCHES REQUIRED FOR EXTRACTING 51RV-1 FROM MOUNT.
2. 9.718 INCHES INCLUDING SWAY SPACE WITH 51RV-1 MOUNTED.

390Y-1 Shockmount, Outline and Mounting Dimensions
Figure 415

51RV-1 VOR/ILS Receiver - Adjustment/Test

1. GENERAL.

The following procedures in paragraph 2 are to be used by line maintenance personnel with the 51RV-1 installed in the aircraft. The tests in this section check the control unit, the indicators, and the interconnecting wiring in the aircraft. Refer to the overhaul manual for detailed alignment and overhaul procedures. No adjustment or repair work should be attempted while the 51RV-1 is installed in the aircraft. If the unit is found to be defective, replace with a spare known to be in good operating condition.

2. PREFLIGHT TESTING PROCEDURES.

A. Ramp Test.

The following test procedures represent typical ramp tests for the 51RV-1 VOR/ILS Receiver. The procedures presented, using the 479T-2, are intended as a go-no-go test for the VOR/ILS system including the antenna, control unit, indicators and interconnecting wiring. If an abnormal indication is obtained, remove the 51RV-1 as outlined in paragraph 2 of the removal/installation section and substitute a 51RV-1 known to be in good operating condition. If the abnormal indication is obtained, check the wiring and other components in the VOR system.

(1) Set the 313N-1/2/3 NAV power switch to PWR and the NAV frequency to 114.90 megacycles.

(2) Apply power to the 479T-2 and set near the aircraft in which the 51RV-1 is installed. Ensure that the 479T-2 is calibrated.

(3) Connect the 479T-2 antenna to the 479T-2 NAV OUTPUT connector, place broadside to the direction the signal is to be radiated, extend to its full length and securely clamp to the 479T-2 case.

(4) Set the 479T-2 METER switch to LINE, the SET LINE to 21V switch to obtain a reading of 21 volts on the meter, the MICROVOLTS control to 200K, and the MEGACYCLES control to 114.9. Set the METER switch to CAR, and adjust the CARRIER SET control to obtain a red-line indication on the meter.

(5) Set the 479T-2 AUDIO SELECTOR to VOR, the NAV-GS switch to NAV, and the VOR control to 0°. The aircraft RMI reading should always correspond to the reciprocal of the VOR control setting.

(6) Set the aircraft 331A-4A Course Indicator course to zero degree. The deviation needle should be centered, the LOC flag should be out of signt, and the TO-FROM indicator should register FROM.

(7) Set the VOR control to 45°. The deviation needle should deflect to the left.

(8) Set the VOR control to 315°. The deviation needle should deflect to the right.

(9) Set the VOR control to 180°. The 331A-4A should register a TO indication, the LOC flag should be out of sight, and the deviation needle should center.

(10) Set the 479T-2 AUDIO SELECTOR to TONE LOC and the MEGACYCLES control to 110.1. Set the 313N-3 NAV frequency to 110.1 megahertz.

(11) Set the 479T-2 LOC-GS control to LEFT. The 331A-4A needle should deflect to the left, and the LOC flag should be out of sight.

(12) Set the 479T-2 LOC-GS control to RIGHT. The 331A-4A deviation needle should deflect to the right.

(13) Connect the 479T-2 antenna to the 479T-2 GS OUTPUT connector, and fully retract the antenna. Set the NAV-GS control to GS and the AUDIO SELECTOR to GLIDE SLOPE.

(14) Set the LOC-GS control to UP. The glideslope deviation needle on the 331A-4A should deflect up, and the GS flag should be out of sight.

(15) Set the LOC-GS control to DOWN. The 331A-4A deviation needle should deflect down.

(16) Set the AUDIO SELECTOR to 1000 ~ , and listen for the 1000-Hz tone in the aircraft headphones.

B. VOR Self-Test.

(1) Apply power to the 51RV-1 and the 313N-1/2/3.

(2) Channel the 51RV-1 to a local VOR frequency.

(3) Set the OBS to 0 degree or 180 degrees.

(4) Actuate the VOR test switch. The deviation bar should center and the RMI pointer should go to 180 degrees. (On the -020 status only, the VOR/LOC flag on the course indicator becomes visible at the same time.)

C. ILS Self-Test.

(1) Apply power to the 51RV-1.

(2) Channel the 51RV-1 to any localizer frequency.

(3) Actuate the UP/LEFT switch. The deviation bar should go to the left and the glideslope bar should move up. The VOR/LOC and the glideslope flags should disappear. Both bars should be positioned halfway between the second and third dot on a 5-dot indicator or on the first dot on a 2-dot indicator.

(4) Actuate the DOWN/RIGHT switch. The deviation bar should go to the right and the glideslope bar should move down. The VOR/LOC and glideslope flags should disappear. Both bars should be positioned halfway between the second and third dot on a 5-dot indicator or on the first dot on a 2-dot indicator.

51RV-1 VOR/ILS Receiver - Inspection/Check

1. GENERAL.

Included within this section are inspection/check procedures for the 51RV-1 VOR/ILS Receiver as installed in the aircraft. The equipment should be inspected periodically.

2. INSPECTION PROCEDURES.

A. Check to ensure that dust cover is securely fastened.

B. Check to ensure that sway space is adequate and that no obstruction hinders shockmount or equipment rack from operating properly.

C. Check to ensure that ventilating holes in dust cover are free from dust and tars.

D. Check for damage to finish.

E. Check cabling to shockmount or aircraft equipment rack for dust, wear, broken wires, or poor connections.

F. Check shock isolators for correct operation.

G. Check to ensure that all shockmount bonding straps are properly installed.

H. Check to ensure that equipment is securely installed on shockmount and that knurled retaining knobs on shockmount are safety wired.

CAUTION: BE SURE THAT THE EQUIPMENT HOUSING AND MOUNT ARE BONDED ELECTRICALLY TO THE AIRFRAME.

51RV-1 VOR/ILS Receiver - Cleaning/Painting

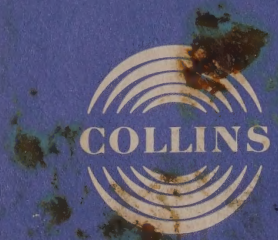
1. GENERAL.

No cleaning or painting is required or recommended while the equipment is installed in the aircraft. Approved cleaning procedures should be performed when the equipment is removed from the aircraft as described in the 51RV-1 VOR/ILS Receiver Overhaul Manual, Collins part number 523-0756524.

51RV-1 VOR/ILS Receiver - Approved Repairs

1. GENERAL.

No repairs should be attempted on this system while the equipment is installed in the aircraft. Complete overhaul instructions are furnished in the 51RV-1 VOR/ILS Receiver Overhaul Manual, Collins part number 523-0756524.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